Permit/ID Number/ Well Number	Basin	Source	Manner of Use	Duty (Af/Year)	Spring Number	Owner
R06951	Kobeh Valley	SPR	OTH	3.93	742	BLM
R06952	Kobeh Valley	UG[3]	OTH	3.93	--	BLM
V01953	Kobeh Valley	STR	IRR	350	--	Bernard Damele
V02781	Pine Valley	STR	IRR	112.33	--	Eureka Livestock Company
204*	Kobeh Valley	UG	STK	Unk	--	Unk
310*	Kobeh Valley	UG	STK	Unk	--	Unk

SPR=Spring, STR=Stream, STK=Stockwater, UG=Underground (well), IRR = Irrigation, OTH = Other (wildlife), Unk=Unknown

[1] - The water right is associated with Roberts Creek; however, NDWR identified the right as a spring in their database.

[2] - The water right is associated with a gravel pit that has water within the pit.

[3] - The water right is associated with a well; however, NDWR identified the right as a spring in their database.

* - Wells 204 and 310 appear to be used for stock watering and there are no water rights associated with these wells.

3.2.3 Environmental Consequences and Mitigation Measures

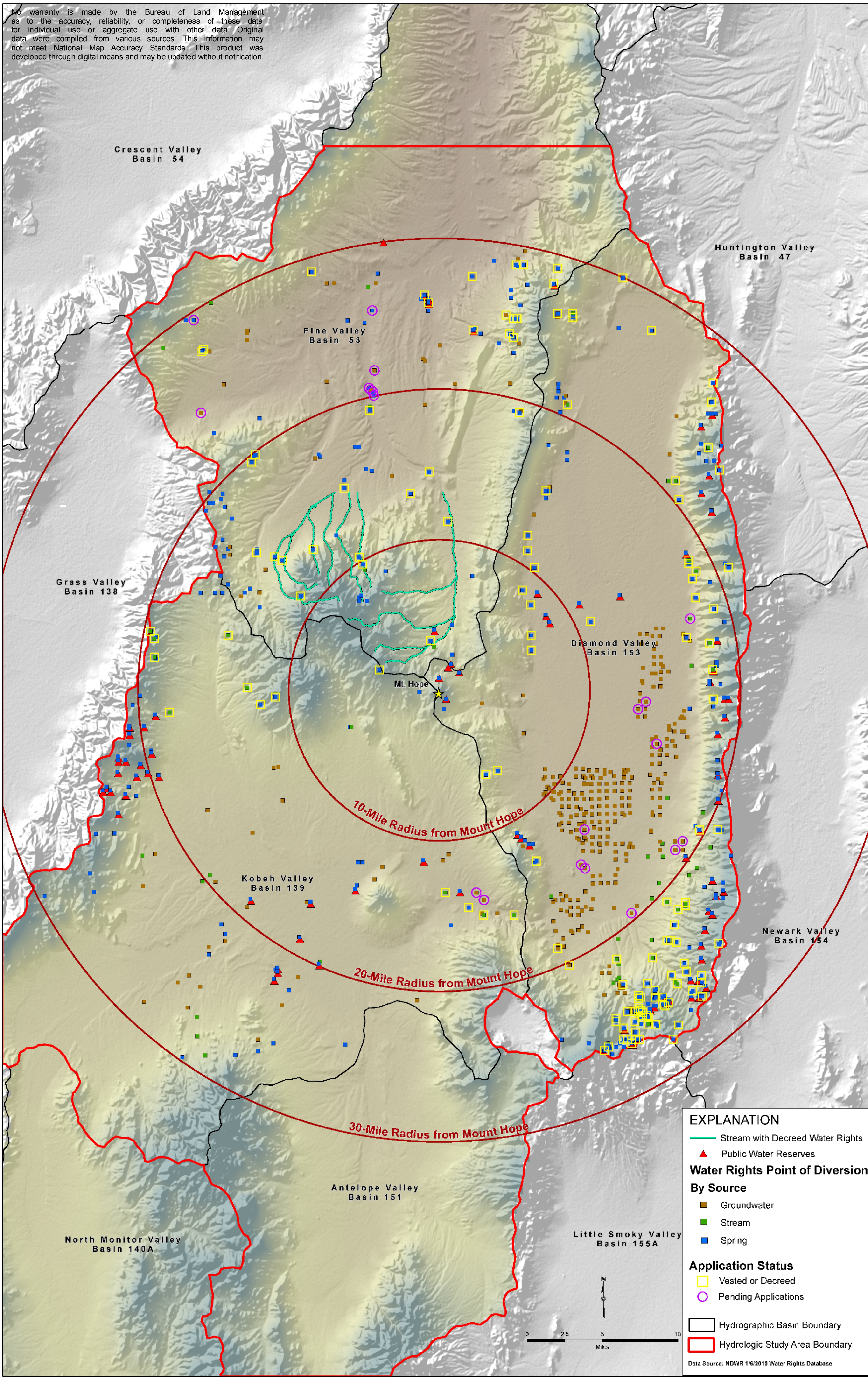
The Proposed Action and alternatives have the potential to impact surface water and ground water in the HSA. Potential water quantity impacts that may be associated with mining operations include the following: 1) reduction in surface and ground water quantity for current users and water-dependent resources from pit dewatering and production well withdrawals; 2) impacts from flooding, erosion, and sedimentation associated with mine construction, operation, and closure activities; and 3) changes in aquifer productivity or surficial drainage patterns or the creation of open fissures at the land surface related to dewatering-induced subsidence. The analysis of the magnitude and significance of these potential water resource impacts in relation to the Proposed Action and alternatives are addressed in this section. Potential water quality impacts are discussed in Section 3.3.3.

3.2.3.1 Significance Criteria

Criteria for assessing the significance of potential impacts to the quantity of water resources in the HSA are described below. Impacts to water resources are considered to be significant if any of these criteria are predicted to occur as a result of the Proposed Action or the alternatives.

3.2.3.1.1 Surface Water Quantity

- Modification or sedimentation of natural drainages resulting in increased area or incidence of flooding.
- Reduction in the flow of springs, seeps, or streams. Impacts are considered to be significant where the predicted ten-foot water table drawdown contour encompasses a spring, seep, or stream and where the surface water feature is determined to be hydraulically connected to the aquifer affected by drawdown.
- Diversion or consumptive use of ground water that adversely affects other (non-EML) water rights holders. This criterion includes flows to springs, seeps, or streams where existing beneficial water uses, as defined by state law, may be affected.



BATTLE MOUNTAIN DISTRICT OFFICE Mount Lewis Field Office 50 Bastian Road Battle Mountain, Nevada 89820	BUREAU OF LAND MANAGEMENT MOUNT HOPE PROJECT	DRAWING TITLE: **Non-EML-Controlled Water Rights and PWRs within HSA and 30-mile Radius of Mount Hope** **Figure 3.2.14**
DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD		
CHECKED: -	APPROVED: -	DATE: 07/07/2011		
FILE NAME: p1635_Fig3-2-X_Hydro_11i17i.mxd		

3.2.3.1.2 Ground Water Quantity

- Reduction of ground water levels that adversely affect water-supply, municipal, domestic, agricultural, or industrial wells caused by Project dewatering or post-mining pit lake development. Impacts are considered to be significant where the predicted ten-foot water table drawdown contour encompasses an existing well with an active water right and the well is hydraulically connected to the aquifer affected by drawdown.
- A long-term consumptive use of a water resource that does not provide for a beneficial use.
- Lowering of ground water levels that result in substantial land subsidence. For the purposes of this EIS, significant impacts are indicated where hydraulic parameters of the aquifer are substantially changed (such that aquifer productivity may be affected), where differential subsidence results in open fissures at the land surface, or if subsidence is great enough to change drainage directions or cause ponding.

For this impact analysis, the area that is predicted to experience a decline in ground water elevation of ten feet or more as a result of mine dewatering and water production activities was selected as the area of **primary focus** regarding impacts to water resources. This is a commonly used approach for EISs in Nevada, in part because changes in ground water levels of less than ten feet generally are difficult to distinguish from natural seasonal and annual fluctuations in ground water levels.

3.2.3.2 Assessment Methodology

This section provides a summary of the methods used to evaluate the following: 1) the expected mine pit dewatering rates, 2) changes in ground water elevations and hydrographic basin water balances due to mining-related production well withdrawals and pit dewatering, and 3) the development and ultimate hydrologic conditions of the post-mining pit lake.

3.2.3.2.1 Numeric Ground Water Flow Modeling

A pair of nested three-dimensional numerical ground water flow models have been developed, calibrated, and utilized to estimate potential effects to ground water and surface water resources from the Proposed Action and No Action Alternative, and from the cumulative effects of historical dewatering and projected future dewatering and water production activities for this EIS. The nested models consist of a larger, regional-scale model (the Regional Model) that encompasses the entire HSA and a smaller, imbedded local-scale model (the Local Model) that is focused on the vicinity of the proposed open pit. The two models are "coupled" by representation of the same time-varying ground water stresses (boundary conditions) in both model domains. Interflow, Inc., prepared the Regional Model, and Montgomery & Associates, prepared the Local Model. A detailed explanation of the conceptual hydrogeologic model, numerical modeling approach and setup, steady-state and transient calibrations, sensitivity analyses, optimization, model coupling, and predictive usage of both the Regional and Local Models is presented in the technical report by Montgomery et al. (2010, Chapter 4). Additional supporting data, analysis, and documentation for the numerical models are presented in Bell (2008), Bell and Arai (2009), Interflow (2010), Montgomery & Associates (2010), and SRK (2008a).

Interflow and Montgomery & Associates conducted the ground water flow modeling using an enhanced version of the USGS numerical code MODFLOW (McDonald and Harbaugh 1984). The enhanced version, known as MODFLOW-SURFACT (HydroGeoLogic 1996), contains many improvements over MODFLOW, including more robust and accurate simulation capabilities for handling complex field conditions (such as large ground water elevation fluctuations, which result in drying and wetting of model grid cells). MODFLOW originally was designed to simulate flow through porous media. However, it is common practice for MODFLOW models to be used to simulate ground water flow in bedrock aquifers where flow through the rock mass is primarily controlled by interconnected fracture or solution networks that behave similarly to porous media flow at the scale of the model grid cells (D'Agnese et al. 1997; Prudic et al. 1995). MODFLOW packages that were utilized in this analysis include the Interbed-Storage Package (Leake and Prudic 1991) to evaluate subsidence effects of dewatering and the LAK2 Package (Council 1999) to evaluate filling of the pit lake after mining.

The Regional Model encompasses the entire HSA as shown in Figure 3.2.1. The Regional Model contains eight variable-thickness layers to simulate the vertical range extending from over 10,000 feet amsl at the peaks of some of the HSA's mountain ranges to zero feet amsl (mean sea level) at the base of the model. To provide better resolution where ground water stresses would be greatest, the model grid cell dimensions vary horizontally from 5,000 feet by 5,000 feet at the outer margins of the model to 1,000 feet by 1,000 feet in the vicinity of the proposed well field and open pit areas. The Regional Model was calibrated to include the following: 1) historic (circa 1955, presumed steady-state) water levels in each of the HSA basins, 2) the estimated agricultural pumping and observed changes in ground water levels in Diamond Valley between 1956 and 2006, and 3) the results of six aquifer pumping tests conducted in carbonate bedrock and basin-fill deposits in Kobeh Valley as part of the baseline studies for this EIS (Interflow 2010).

The Local Model domain is nested within the Regional Model and covers a rectangular area of approximately 28 square miles, which includes Mount Hope and extends roughly two miles to the north, west, and south and five miles to the east of the proposed open pit, as shown in Figure 3.2.1. The Local Model consists of 19 horizontal layers of different thickness spanning the vertical range from the top of Mount Hope (8,411 feet amsl) to zero feet amsl (mean sea level) at the base of the model. Horizontal grid cell dimensions range from 100 feet by 100 feet in the proposed open pit area to 800 feet by 800 feet along the edges of the Local Model. These refined grid cells in the Local Model, relative to the Regional Model, allow the Local Model to more accurately represent hydrologic features, such as fault zones and steep hydraulic gradients, well locations, open pit geometry, and ground water levels, in the proposed mining area. The Local Model was calibrated to observed 2009 water levels in the proposed open pit area, which were assumed to represent steady-state conditions, and to the measured transient responses to three aquifer pumping tests conducted in the open pit area dewatering test wells as part of the baseline studies for this EIS (Montgomery & Associates 2010).

Transient, predictive Regional and Local Model simulations were developed to assess the potential water quantity impacts of the Proposed Action, No Action Alternative, and cumulative effects of historic dewatering and projected future dewatering and water management activities. Potential water quantity impacts due to the Partial Backfill Alternative were evaluated in a modeling assessment using the same methodologies as used for the Proposed Action, except modifying those parameters that would reflect the backfilling of the open pit (Montgomery &

Associates 2011). The Off-Site Transfer of Ore Concentrate for Processing Alternative would require the same mining-related production well pumping, pit dewatering, and water production activities, and would result in the same development of the pit lake, as the Proposed Action; therefore, the potential water quantity impacts of the Off-Site Transfer of Ore Concentrate for Processing Alternative and the Proposed Action are considered to be the same. Potential water quantity impacts due to the Slower, Longer Project Alternative were evaluated in a modeling assessment using the same methodologies as used for the Proposed Action, except modifying those parameters that would reflect a doubling of the mining and pumping time frames and a one-half decrease in the production field pumping rate (Interflow 2011).

3.2.3.2.2 Modeling Scenarios

The calibrated Regional Model was used to simulate a "No Action Alternative Scenario" and a "Cumulative Action Scenario," both of which are identical for the historical time period from 1955 through 2009, but differ for the predictive time period beginning in 2010. The modeling assumptions regarding anthropogenic ground water withdrawals during the predictive time period for the two scenarios are summarized as follows:

No Action Alternative Scenario

The No Action Alternative Scenario includes all of the relevant existing ground water withdrawals within the HSA, as outlined below.

- Consumptive use of ground water for agricultural irrigation in Diamond Valley continues at 2009 rates (34,630 gpm or 55,850 afy) through 2106, and then is reduced by 60 percent (to 13,850 gpm or 22,340 afy) for the remainder of the simulated time period to constrain the drawdown to approximately 300 feet bgs (Figure 3.2.15). The modeling of the future agricultural consumptive use in Diamond Valley as a step function is a more conservative assumption than using a monotonically declining curve, in terms of water consumption. It is entirely possible that future ground water use could continue at rates similar to the present until the currently available water supply (in the upper part of the aquifer tapped by the agricultural wells) is depleted.

- Consumptive use of ground water for agricultural irrigation in Kobeh Valley continues at 2006 rates (1,800 gpm or 2,900 afy, at the Bobcat Ranch) through 2011 and then increases to 2,330 gpm (3,750 afy) at the Bobcat and 3F Ranches for the remainder of the simulated time period.

- Town of Eureka municipal water-supply pumping continues at 2006 rates (190 gpm or 300 afy) throughout the simulated time period.

- Consumptive use of ground water at the Ruby Hill Mine continues at 2006 rates (280 gpm or 450 afy) through 2012 and then ceases.

Cumulative Actions Scenario

The cumulative actions scenario includes all of the assumed consumptive uses listed above for the No Action Alternative Scenario plus the following ground water withdrawals related to the Proposed Action.

- Mine construction water supply is pumped from two wells in the proposed mining area at a combined rate of 300 gpm (480 afy) for one year (2011).

- Production well pumping for the proposed mining and milling operations in the Kobeh Valley Central Well Field (KVCWF) continue for 44 years; the amount of water extracted at the KVCWF varies yearly depending on the volume of water derived from open pit dewatering during mining, with the sum of the two water-supply sources equaling the total process-water demand of 7,000 gpm (11,300 afy) on an annualized average basis.

- Pit dewatering **would** continue **for** 32 years; **and** pit lake formation begins in **Year 32**.

Historic pumping rates and projected future ground water withdrawals are summarized in Table 3.2-7 and shown on Figure 3.2.15.

The Local Model was coupled to the Regional Model simulation of the Cumulative Action Scenario for the predictive time period beginning in 2010. Lateral boundary conditions for the Local Model (specified hydraulic heads) were derived from the Regional Model via an iterative process that is explained in Montgomery et al. (2010). The Local Model was used to estimate the following:

- Passive ground water inflow rates to the mine open pit during the 32-year mining period;

- Pit lake formation (filling time, final lake stage) after dewatering ceases;

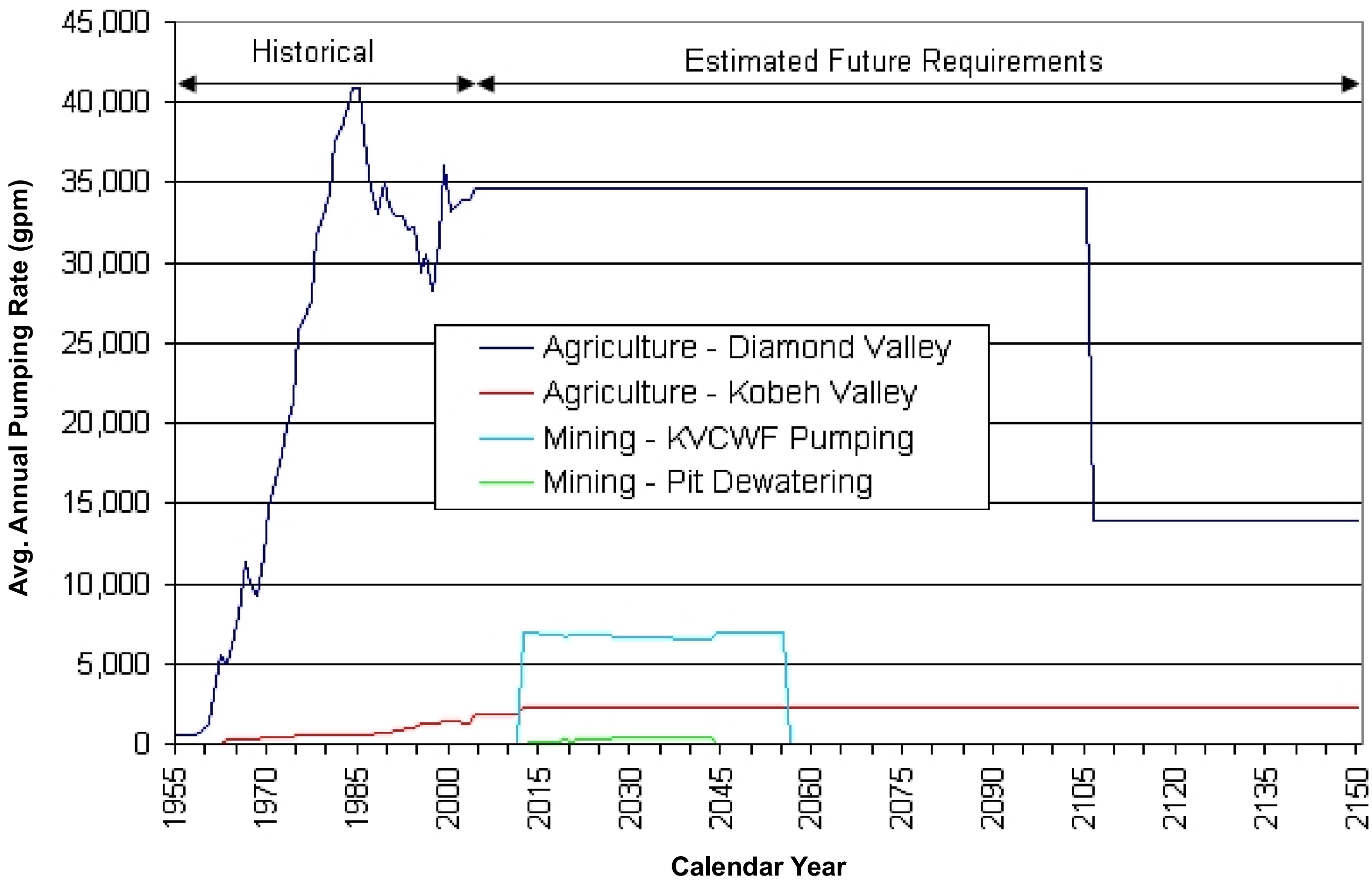
- The ground water inflow and outflow component(s) of the pit lake water balance;

- Whether the pit lake would act as a hydrologic sink for ground water or as a through-flow system; and

- Ground water stresses from open pit dewatering and pit lake development, which feed back into the Regional Model to complete the model coupling process.

3.2.3.2.3 Pit Dewatering and Water Supply Pumping

The open pit excavation is planned to commence late **in the construction phase**, with one year of pre-production followed by 32 years of production. Upon completion, the open pit would extend downward approximately 2,550 feet bgs and would cover an area of approximately 730 acres. Existing ground water levels near the center of the proposed open pit are approximately 300 feet bgs; therefore, a ground water drawdown of approximately 2,250 feet would be required during mining operations to lower the ground water level to below the ultimate open pit bottom. Inflowing ground water would be pumped from sumps in the pit and removed for consumptive use in the mining and milling process. The results of the numerical ground water modeling indicate that the open pit dewatering requirements under the Proposed Action (and the Partial Backfill Alternative and the Off-Site Transfer of Ore Concentrate for Processing Alternative) would range from approximately 60 to 460 gpm (100 to 750 afy) on an average annual basis, as listed in Table 3.2-7 and shown on Figure 3.2.15.



Note: Agricultural pumping is the annual net agricultural pumping, which is not the consumptive loss when referring to irrigation withdrawals.

BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD			
CHECKED: -	APPROVED: RFD	DATE: 08/06/2012			
FILE NAME: p1635_Fig3-2-X_Hydro_8i11i.mxd					

BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Historical Pumping and Estimated Future Pumping and Dewatering Requirements

Figure 3.2.15

Table 3.2-7: Summary of Historic Pumping and Estimated Future Pumping and Dewatering Requirements

Project Year	Calendar Year[1]	No Action Alternative				Proposed Action		Partial Backfill Alternative	
		Net Agricultural Pumping (gpm)[2]			Other[3] (gpm)	KVCWF Pumping (gpm)	Pit Inflow[4,5] (gpm)	KVCWF Pumping (gpm)	Pit Inflow[4] (gpm)
		Diamond Valley	Kobeh Valley	Total					
	1955	510	0	510	0	0	0	0	0
	1956 - 2009	510 - 40,830	0 - 1,800	510 - 41,450	70 - 470	0	0	0	0
	2010	34,630	1,780	36,410	470	0	0	0	0
0	2011	34,630	1,780	36,410	470	0	300	0	300
1	2012	34,630	2,330	36,960	470	6,940	60	6,940	60
2	2013	34,630	2,330	36,960	190	6,910	90	6,910	90
3	2014	34,630	2,330	36,960	190	6,930	70	6,930	70
4	2015	34,630	2,330	36,960	190	6,820	180	6,820	180
5	2016	34,630	2,330	36,960	190	6,860	140	6,860	140
6	2017	34,630	2,330	36,960	190	6,850	150	6,850	150
7	2018	34,630	2,330	36,960	190	6,840	160	6,840	160
8	2019	34,630	2,330	36,960	190	6,690	310	6,690	310
9	2020	34,630	2,330	36,960	190	6,800	200	6,800	200
10	2021	34,630	2,330	36,960	190	6,780	220	6,780	220
11	2022	34,630	2,330	36,960	190	6,750	250	6,750	250
12	2023	34,630	2,330	36,960	190	6,750	250	6,750	250
13	2024	34,630	2,330	36,960	190	6,750	250	6,750	250
14	2025	34,630	2,330	36,960	190	6,750	250	6,750	250
15	2026	34,630	2,330	36,960	190	6,750	250	6,750	250
16	2027	34,630	2,330	36,960	190	6,640	360	6,640	360
17	2028	34,630	2,330	36,960	190	6,640	360	6,640	360
18	2029	34,630	2,330	36,960	190	6,640	360	6,640	360
19	2030	34,630	2,330	36,960	190	6,640	360	6,640	360
20	2031	34,630	2,330	36,960	190	6,640	360	6,640	360
21	2032	34,630	2,330	36,960	190	6,610	390	6,610	390
22	2033	34,630	2,330	36,960	190	6,610	390	6,610	390
23	2034	34,630	2,330	36,960	190	6,610	390	6,610	390
24	2035	34,630	2,330	36,960	190	6,610	390	6,610	390
25	2036	34,630	2,330	36,960	190	6,610	390	6,610	390
26	2037	34,630	2,330	36,960	190	6,540	460	6,540	460
27	2038	34,630	2,330	36,960	190	6,540	460	6,540	460
28	2039	34,630	2,330	36,960	190	6,540	460	6,540	460
29	2040	34,630	2,330	36,960	190	6,540	460	6,540	460
30	2041	34,630	2,330	36,960	190	6,540	460	6,540	460
31	2042	34,630	2,330	36,960	190	6,580	420	6,580	420
32	2043	34,630	2,330	36,960	190	6,580	420	6,580	420
33	2044	34,630	2,330	36,960	190	7,000	180	7,000	0

Project Year	Calendar Year[1]	No Action Alternative				Proposed Action		Partial Backfill Alternative	
		Net Agricultural Pumping (gpm)[2]			Other[3] (gpm)	KVCWF Pumping (gpm)	Pit Inflow[4,5] (gpm)	KVCWF Pumping (gpm)	Pit Inflow[4] (gpm)
		Diamond Valley	Kobeh Valley	Total					
34	2045	34,630	2,330	36,960	190	7,000	180	7,000	0
35	2046	34,630	2,330	36,960	190	7,000	180	7,000	0
36	2047	34,630	2,330	36,960	190	7,000	170	7,000	0
37	2048	34,630	2,330	36,960	190	7,000	170	7,000	0
38	2049	34,630	2,330	36,960	190	7,000	170	7,000	0
39	2050	34,630	2,330	36,960	190	7,000	160	7,000	0
40	2051	34,630	2,330	36,960	190	7,000	160	7,000	0
41	2052	34,630	2,330	36,960	190	7,000	160	7,000	0
42	2053	34,630	2,330	36,960	190	7,000	160	7,000	0
43	2054	34,630	2,330	36,960	190	7,000	150	7,000	0
44	2055	34,630	2,330	36,960	190	7,000	150	7,000	0
	2056 - 2105	34,630	2,330	36,960	190	0	150 - 120	0	0
	2106 - end	13,850	2,330	16,180	190	0	120 - 60	0	0

[1]Calendar years used for numerical ground water flow model simulations; actual startup dates for the Proposed Action or Partial Backfill Alternative would depend on BLM and NDEP authorizations.
[2]Net agricultural pumping means net consumptive loss when referring to irrigation withdrawals. Average annual flow rate in gpm, rounded to nearest ten gpm.
[3] Includes Town of Eureka municipal water-supply pumping and Ruby Hill Mine pumping.
[4] Pit inflow value for Project Year Zero is local mine-area pumping for construction water.
[5] Pit inflow values after Project Year 32 are passive ground water inflows permanently lost to pit lake storage and/or evaporation from the lake's surface.

In addition to open pit dewatering, the Proposed Action (and the Partial Backfill Alternative and the Off-Site Transfer of Ore Concentrate for Processing Alternative) would also involve pumping from the KVCWF for mining and milling water supply starting in 2012 and continuing for 44 years. The water-supply pumping was simulated from ten wells located along the well field corridor in central Kobeh Valley, as shown in Figure 3.2.1. Approximately ten percent of the total well field production was withdrawn from simulated wells in carbonate bedrock, whereas the remaining 90 percent was withdrawn from simulated wells in the basin-fill aquifer (Montgomery et al. 2010). The simulated KVCWF total production during the planned 44 years of operation ranged from 6,540 to 7,000 gpm (10,550 to 11,300 afy) on an average annual basis, as listed in Table 3.2-7 and shown on Figure 3.2.15.

The assessment of cumulative impacts associated with the proposed mine dewatering and KVCWF pumping include an evaluation of the total drawdown from all past, present, and reasonably foreseeable future mine dewatering, production well pumping, and other withdrawals of ground water for consumptive use. This includes the following: 1) historic pumping for agricultural irrigation in Diamond and Kobeh Valleys and continuing through the present; 2) projected future ground water withdrawals for agricultural irrigation, municipal water supply and mining and milling uses by other mines within the HSA; and 3) projected future dewatering and KVCWF pumping requirements for the Proposed Action.

3.2.3.2.4 Evaluation of Impacts to Ground Water Levels

The method used for calculating ground water drawdown for the Proposed Action, No Action Alternative, and cumulative effects assessment are described in detail in Montgomery et al. (2010). Briefly, the predicted water-table drawdown for the No Action Alternative was calculated by subtracting the No Action Alternative Scenario predicted water-level elevations at a certain time in the future (approximately 2055) from the simulated water-level elevations at the end of 2009 (Figure 3.2.16), thus illustrating only the predicted future drawdown relative to existing conditions. The predicted water-table drawdown for the cumulative effects assessment was calculated by subtracting the Cumulative Action Scenario predicted water-level elevations at a certain time in the future from the simulated water-level elevations in 1955, thus relating the simulated historic drawdown and the predicted future drawdown to pre-development conditions (Figure 3.2.11). The predicted water-table drawdown for the Proposed Action was calculated by subtracting the simulated No Action Alternative Scenario water-level elevations from the Cumulative Action Scenario water level elevations at the same point(s) in time in the future. By using this methodology, the predicted results for the Proposed Action do not include the simulated changes to ground water elevations that have occurred in the HSA due to the historic pumping and ground water consumption that occurred between 1955 and the end of 2009, which are shown in Figure 3.2.17. Hence, the baseline condition used as the reference for comparison of the Proposed Action and the alternatives is the simulated existing ground water elevations at the end of 2009, whereas for the cumulative analysis the baseline condition is the estimated pre-development steady-state ground water elevations that existed in 1955.

A ten-foot drawdown contour has been used in the analysis as the reference point for determining potential impacts. The use of a numeric flow model to project potential drawdown at magnitudes of less than approximately ten percent of the local magnitude of drawdown becomes progressively uncertain as the threshold for drawdown prediction decreases. While the numeric model produces values of drawdown to small fractions of a foot, extrapolated over vast distances (the entire model domain), the numbers at this level of precision become an artifact of numeric processes rather than a representation of a physical reality. This is due to physical and mathematical simplifications necessary to model the regional flow system. While there is no standardized way of determining a reporting threshold, the value of ten feet is believed to be commensurate with the predictive qualities and uncertainties associated with this particular model. It is acknowledged that lesser degrees of drawdown can have impacts, however, modeling in this complex geologic setting has its limitations, and to report modeling results to very small thresholds would project a false level of model utility.

In addition, the magnitude, timing, and areal extent of drawdown was evaluated by analyzing the model simulation results at eight selected time intervals that represent the projected conditions at the end of the proposed mining/milling operations (in 2055) and at ten, 30, 50, 100, 200, 300, and 400 years after KVCWF pumping ceases under the Proposed Action.

3.2.3.3 Proposed Action

3.2.3.3.1 Surface Water Resources

Erosion, Sedimentation, and Flooding within Drainages

The Project would require the alteration or diversion of existing natural drainages and washes that contain surface flow during the infrequent periods of high rainfall and snowmelt from the Roberts Mountains and at Mount Hope. All of the planned storm water diversion structures are designed to carry estimated peak flows of a 100-year, 24-hour storm event, with additional capacity to safely pass the inflow design flood peak flow during operations and at closure.

Surface disturbance generally causes an increase in erosion. Therefore, sediment from increased erosion may be transported to and accumulate in the local surface drainages. During mine operation, standard erosion prevention and maintenance procedures (see Section 2.1.7.4) would reduce impacts to less than significant levels.

Small drainages affected by roads and small facility structures would be returned to their natural condition during reclamation. Permanent drainage alterations around the open pit, TSFs, and WRDFs would consist of open channels and berms. Such features would be left in place and reclaimed using revegetation or rock lining for stability and elimination of long-term maintenance under post-closure conditions.

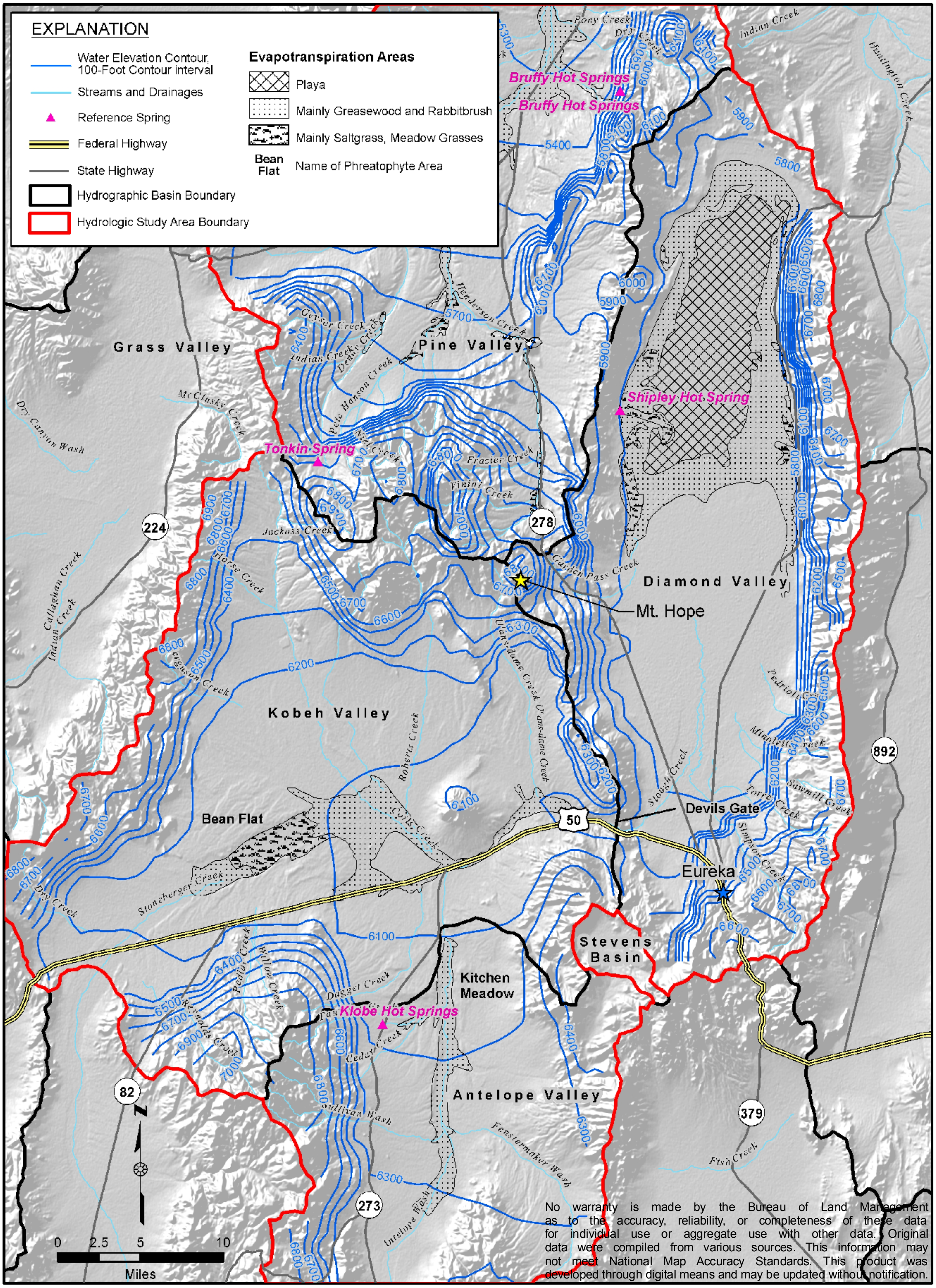
■ **Impact 3.2.3.3-1:** Grading, earth moving, diversion of drainages, and placement of fill could accelerate erosion and sedimentation, and alter surface water flood runoff patterns during mining and post-closure.

Significance of the Impact: The impact is not considered significant.

No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Effects of Ground Water Drawdown on Streams, Springs, and Surface Water Resources

Dewatering would be required in the open pit during the mining phase of the Project. The open pit dewatering would be achieved with in-pit sumps and, if necessary, horizontal drains and perimeter wells would also be used. The average pit inflow rate is estimated to range between 60 to 460 gpm (100 to 750 afy), commencing in Year 1 of the Project and continuing through Year 32, as shown in Table 3.2-7. In addition, ground water pumping in the KVCWF area for process-water supply would be achieved with high capacity production wells completed in the basin-fill and carbonate bedrock aquifers. The average total combined pumping rate of the well field is estimated to range between 6,540 to 7,000 gpm (10,550 to 11,300 afy), commencing in Year 1 of the Project (2012) and continuing through Year 44 (2055), as shown in Table 3.2-7. The open pit dewatering activities and KVCWF pumping would lower (draw down) the water table in the vicinity of those facilities. The predicted maximum drawdown in the bedrock of the open pit area is approximately 2,250 feet, whereas in central Kobeh Valley, the predicted maximum drawdown is approximately 120 feet near the center of the well field after 44 years of



Date: 07/07/10. Filename: z:\Interflowshare\MountHope_GIS_Project\RevisedFigures_June2010\2009WaterLevels_MA_Rev.mxd.

Source: Montgomery et al. (2010).

BATTLE MOUNTAIN DISTRICT OFFICE Mount Lewis Field Office 50 Bastian Road Battle Mountain, Nevada 89820			
DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD	
CHECKED: -	APPROVED: RFD	DATE: 09/22/2011	
FILE NAME: p1635_Fig3-2-X_Hydro_8i11i.mxd			

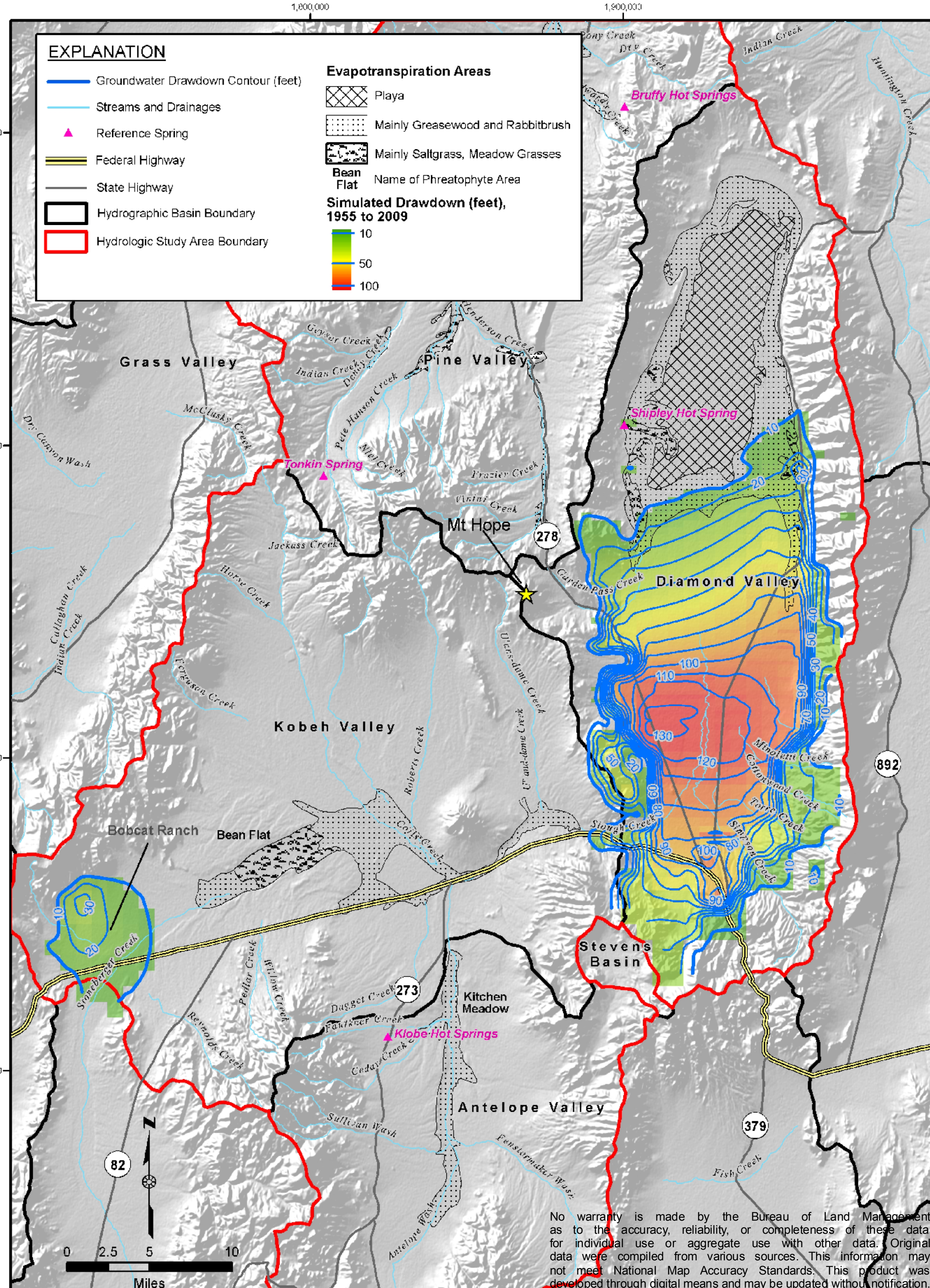
BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Simulated Ground Water Elevations in 2009

Figure 3.2.16



Date: 04/26/10 Filename: Z:\interflowshare\projectfiles\MountHope_GIS_Project\Transient_Model\Cumulative\WorkingDraft_MA\CurrentConditionsDDLayer1_2009_MA.mxd UTM83 NAD83, Zone11

BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD
CHECKED: -	APPROVED: RFD	DATE: 05/09/2011
FILE NAME: p1635_Fig3-2-X_Hydro_8i11i.mxd		

BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Simulated Water Table Drawdown in 2009, Relative to Pre-Development Conditions (circa 1955)

Figure 3.2.17

pumping. This section investigates the potential for drawdown of the water table to affect surface water flow in certain streams and springs.

Figure 3.2.18 shows, graphically, the results of the numerical ground water flow model expressed as water table drawdown contours at the end of the mining and milling operations under the Proposed Action. This figure illustrates areas where the water levels are predicted to decrease over time, in comparison to the existing baseline ground water elevations at the end of 2009, due solely to the Proposed Action. By the end of the mining and milling operations (in 2055), two distinct drawdown areas are predicted to develop: one area centered on the open pit and the other area surrounding the KVCWF wells. These ground water modeling results indicate that the ground water would be drawn down by more than ten feet at 1**2** spring locations and at one perennial stream segment (Roberts Creek) at the end of the mining and milling operations. **In addition, three of these springs (619, 639, and 646) would also be directly affected by the construction of Project components.** The ground water level is not expected to be drawn down by more than ten feet at any other spring or perennial stream segment at the end of mining/milling operations. Ten of the potentially affected springs (Table 3.2-8) and the perennial stream segments appear to be associated with water rights, as listed in Table 3.2-6. There are no PWRs within the ten-foot drawdown. In addition, springs that have not been identified as having PWRs, but may have sufficient flows (1,800 **gallons per day [**gpd**]**) to support a PWR claim could be affected. **Impacts to surface water resources could occur in areas with less than ten feet of predicted drawdown. The ground water modeling is less precise at predicting ground water changes at levels less than ten feet, particular in areas distant from the pumping sources, as such, using the hydrologic model to predict drawdown to a level less than ten feet does not represent the best science.** It should be noted that the plotted spring locations in Figure 3.2.18 and other figures showing drawdown were obtained from various sources, as described in Section 3.2.2.3.2, whereas the water rights locations were derived from NDWR files. Both data sets appear on the figures; however, it should be understood that a single spring may be represented by more than one point; its actual location and in addition one or more associated water rights locations.

Table 3.2-8: Springs that May be Affected by Project Activities

Spring Number	Spring Name	Basin	Flow (gpm)	Use
578	Unnamed Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses
583	Unnamed Spring	Pine Valley	--	Livestock, Wildlife, and Wild Horses
587	Unnamed Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses
592	Unnamed Spring (OT-2)*	Pine Valley	9.03	Livestock, Wildlife, and Wild Horses
597	Garden Spring	Pine Valley	<0.1	Livestock, Wildlife, and Wild Horses
600	Unnamed Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses
601	Unnamed Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses
604	Unnamed Spring	Diamond Valley	<0.1	Livestock, Wildlife, and Wild Horses
605	Unnamed Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses
608	Unnamed Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses
609	Unnamed Spring (OT-5)*	Pine Valley	--	Livestock, Wildlife, and Wild Horses
610	Unnamed Spring (OT-3)*	Pine Valley	1.53	Livestock, Wildlife, and Wild Horses
612	McBrides Spring*	Diamond Valley	1.8	Livestock, Wildlife, and Wild Horses

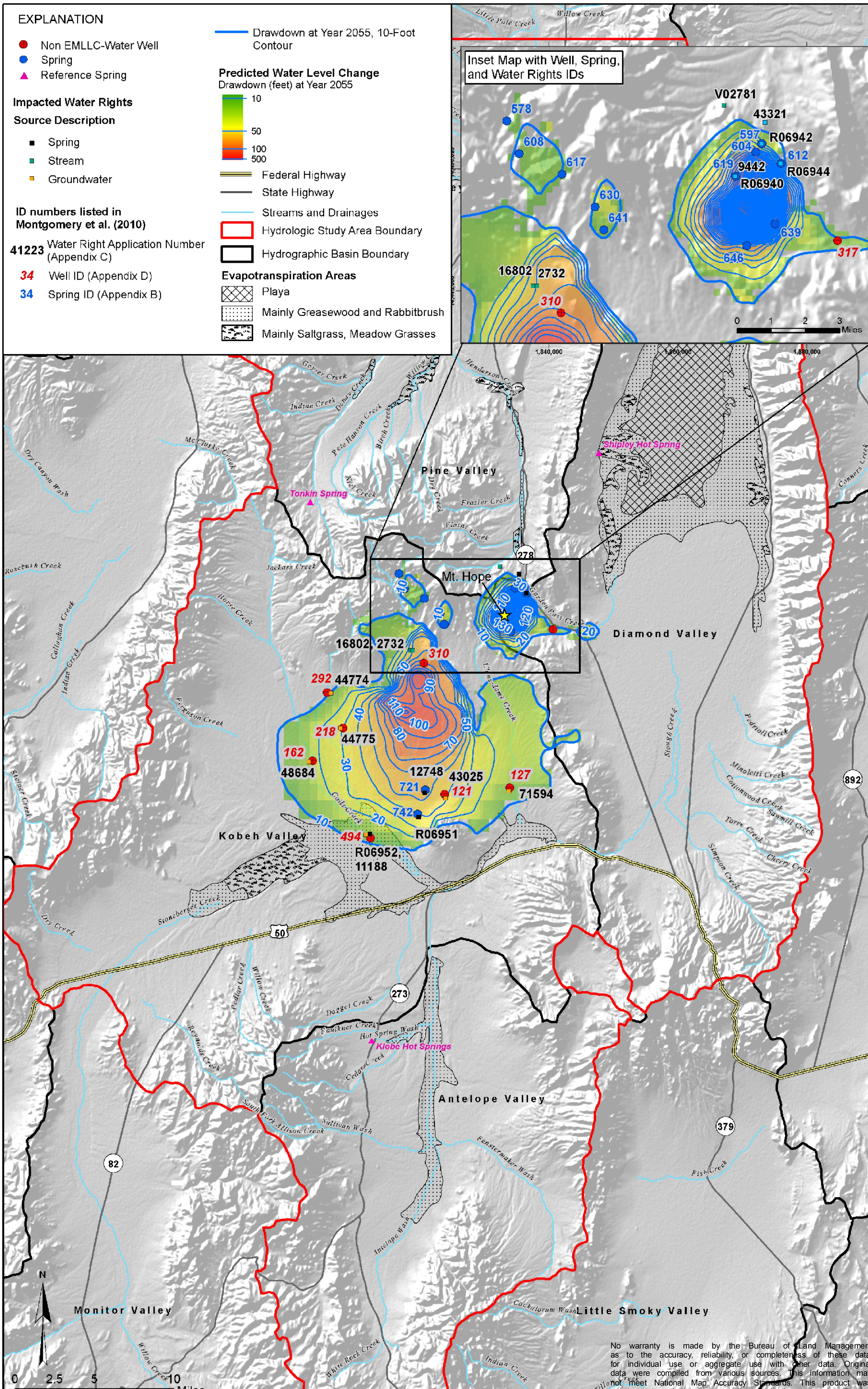
Spring Number	Spring Name	Basin	Flow (gpm)	Use
617	Unnamed Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses
619	Mount Hope Spring*	Diamond Valley	0.03	Livestock, Wildlife, and Wild Horses
630	Unnamed Spring (OT-8)*	Kobeh Valley	6.97	Livestock, Wildlife, and Wild Horses
634	Farrington Spring	Kobeh Valley	<1	Livestock, Wildlife, and Wild Horses
639	Zinc Adit	Diamond Valley	8	Livestock, Wildlife, and Wild Horses
641	Unnamed Spring (OT-7)*	Kobeh Valley	2.36	Livestock, Wildlife, and Wild Horses
646	Unnamed Spring (SP-7)	Diamond Valley	--	Livestock, Wildlife, and Wild Horses
721	Mud Spring*	Kobeh Valley	<1	Livestock, Wildlife, and Wild Horses
742	Lone Mountain Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses

*** Indicates a spring that is likely to be perennial.**

After dewatering ceases, the ground water would begin to recover in the open pit area. Similarly, ground water in the basin-fill and bedrock aquifers of Kobeh Valley would begin to recover when **production water** pumping in the KVCWF ceases **(Year 42)**. The limits of ground water drawdown surrounding the open pit and KVCWF would continue to expand in the perimeter areas after open pit dewatering and production well pumping cease, as the open pit and dewatered portions of the aquifers fill with ground water that is derived from storage as well as natural recharge. Due to aquifer geometry and heterogeneity, the rate and ultimate extent of continued lateral expansion of drawdown would not be the same in all directions. Figure 3.2.19 shows the simulated ten-foot water table drawdown contours at ten, 50, 100, 150, 200, 250, 300, 350, and 400 years of post-Project recovery, and illustrates the composite maximum-extent-of-drawdown used in this analysis. The boundary of the maximum-extent-of-drawdown encompasses all of the areas that are predicted to experience more than ten feet of drawdown at any time in the future due to the Proposed Action. In the vicinity of Mount Hope, the maximum extent of the ten-foot drawdown contour is approximately one mile beyond its location at the end of the mining and milling operations, whereas for the area surrounding the KVCWF, the difference generally is much less (on the order of 0.1 mile) beyond the ten-foot drawdown contour at the end of active pumping.

The maximum extent of the ten-foot drawdown contour encompasses 22 springs, two perennial stream segments (Roberts Creek and Henderson Creek), and portions of four intermittent and ephemeral stream drainages (Coils Creek, Rutabaga Creek, U'ans-in-dame Creek, and Garden Pass Creek), as shown in Figure 3.2.20. As discussed in Section 3.2.2.3.1, the stream reaches and springs located in this area can be characterized as either intermittent, ephemeral, or perennial. Intermittent and ephemeral stream reaches and spring sites flow only during or after wet periods in response to rainfall or snowmelt runoff events. By definition, these surface waters are not controlled by discharge from the regional ground water system. During the low flow period of the year (late summer through fall), intermittent and ephemeral stream reaches and springs typically would be dry.

In contrast, perennial stream segments and springs generally flow throughout the year. Flows observed during the wet periods, which typically extend from spring through early summer, include a combination of surface runoff and ground water discharge, whereas flows observed during the low-flow period are sustained entirely by discharge from the ground water system. If the flow in these stream segments and springs relies on the aquifer that is being dewatered, a



BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD	
CHECKED: -	APPROVED: -	DATE: 09/22/2011	
FILE NAME: p1635_Fig3-2-X_Hydro_11i17i.mxd			

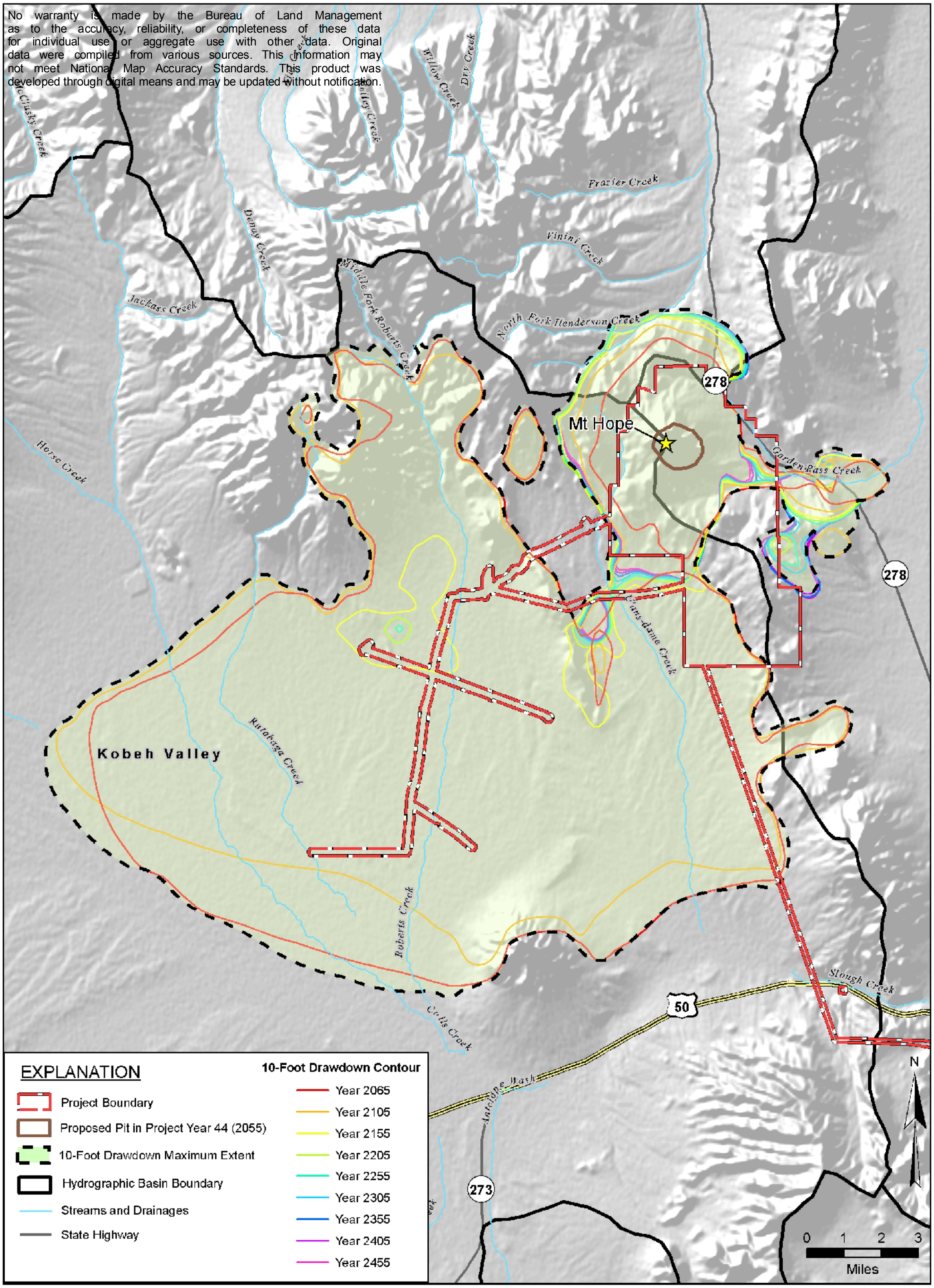
BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Proposed Action Simulated Ground Water-Level Change in Year 2055, Relative to 2009 Conditions

Figure 3.2.18



BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD
CHECKED: -	APPROVED: RFD	DATE: 08/03/2012
FILE NAME: p1635_Fig3-2-X_Hydro_8i11i.mxd		

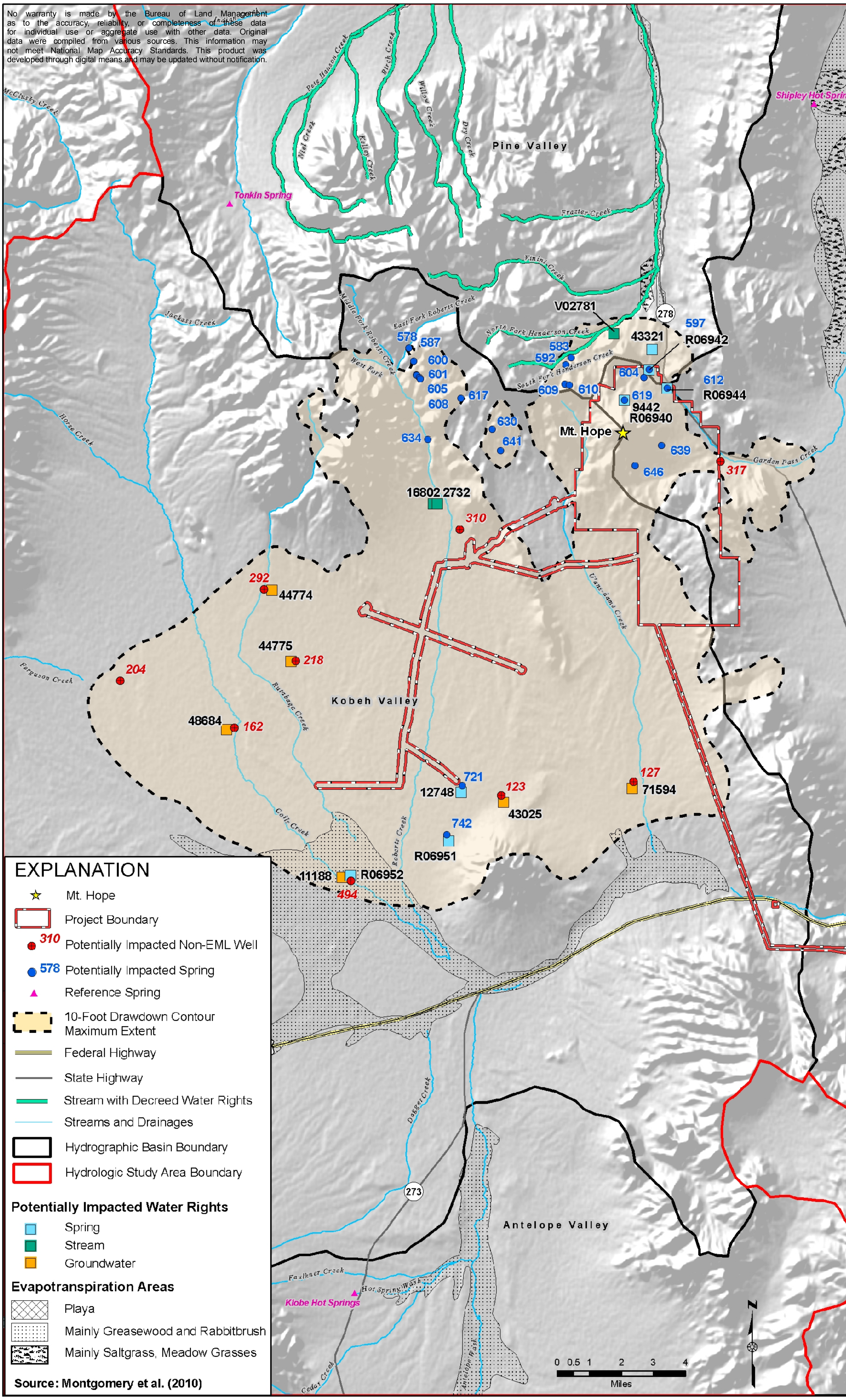
BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Proposed Action Simulated Ten-Foot Water Table Drawdown Contours During 400 Years of Post-Mining Recovery

Figure 3.2.19



BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN:	EMLLC	DRAWN:	GSL	REVIEWED:	RFD
CHECKED:	-	APPROVED:	-	DATE:	08/03/2012
FILE NAME:	p1635_Fig3-2-X_Hydro_11i17i.mxd				

BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Water Rights within the Proposed Action Simulated Maximum Extent of Ten-Foot Water Table Drawdown

Figure 3.2.20

reduction of ground water levels from mine-induced drawdown could reduce the ground water discharge to perennial stream segments or springs. The Pete Hanson Decree adjudicates all stream waters tributary to both Pete Hanson and Henderson Creek. The decree grants water rights subject to restrictions on points of diversion, season of use, and total duty. **Additional surface water resources that are covered by water rights, and not subject to the Pete Hanson Decree, include Roberts Creek and springs in Kobeh Valley.** Potential adverse effects to water rights from the Project would be mitigated **under** NDWR jurisdiction. **The BLM would not address or mitigate impacts to water rights.**

Of the 22 potentially impacted springs, six appear to be associated with water rights (Table 3.2-6) and at least eight are considered perennial (Table 3.2-8). The identified potentially-impacted perennial springs are all located at high elevations in the Roberts Mountains and on the flanks of Mount Hope, and within approximately four miles of the proposed open pit. The source of these springs is believed to be the fractured bedrock aquifer, which receives recharge from the higher elevations as infiltration of snowmelt and rainfall.

Surface water flow in Roberts Creek, located approximately 6.5 miles west of the proposed open pit, is fed by springs that flow into Roberts Creek or its tributaries. The upper spring-fed segments of Roberts Creek generally flow throughout the year, **and as with other springs in the upper elevations of Roberts Mountain,** the springs within the drawdown area that feed those segments are believed to originate in areas of localized, perched ground water that are not hydraulically interconnected with the regional ground water system. It is **also** possible that geologic block faulting has compartmentalized the ground water flow at some of these spring sites so that they would be isolated from mine-induced drawdown, but there is no available evidence to define such conditions if they exist. For the purposes of this analysis, it was conservatively assumed that all of the springs located in the area **projected to experience ten feet or more of drawdown** are interconnected with the regional ground water system and potentially could be impacted due to water-table lowering attributable to the Proposed Action.

Surface flow in Roberts Creek diminishes below the confluence of its upper three forks, where the creek enters a small limestone canyon for approximately one mile and then opens into a broad alluvial channel after the stream exits the mountain valley. It is assumed that stream flow in that reach potentially could be impacted due to water-table lowering attributable to the Proposed Action because the simulated ground water drawdown is greater than ten feet beneath a perennial segment of Roberts Creek.

Surface water flow in the South Fork of Henderson Creek, located approximately three miles northwest of the proposed open pit, is perennial and is believed to be sustained by both perennial and non-perennial springs in headwater drainages that feed into the creek. Year-round flow occurs along at least a two-mile segment of the South Fork of Henderson Creek and ceases near its confluence with the North Fork of Henderson Creek, where all of the surface water flow infiltrates into the stream bed. Then approximately ten miles downgradient, the flow resurfaces, where it is used for irrigation. It is assumed that stream flow in that reach potentially could be impacted due to water table lowering attributable to the Proposed Action because the simulated ground water drawdown is greater than ten feet beneath a perennial segment of the South Fork of Henderson Creek. The other streams in the HSA are either located outside of the maximum-extent-of-drawdown induced by the Proposed Action, or are intermittent or ephemeral streams that would not be expected to be significantly impacted by mine-related dewatering and KVCWF pumping.

The actual impacts to individual stream reaches or springs would depend on the source of ground water that sustains the flow (perched or hydraulically isolated aquifer versus regional ground water system) and the actual extent of mine-induced drawdown that occurs in the area. The interconnection (or lack thereof) between surface water features and deeper ground water sources is controlled in large part by the specific hydrogeologic conditions that occur at each site. Considering the complexity of the hydrogeologic conditions in the region and the inherent uncertainty in numerical modeling predictions relative to the exact areal extent of a predicted drawdown area, it is not possible to conclusively identify specific stream segments or springs that would or would not be impacted by future mine-induced ground water drawdown**; however, for the springs nearest to the open pit, flows would be reduced or eliminated in perpetuity**.

If the Project is approved, EML would be required to monitor surface and ground water to assess the extent of drawdown from open pit dewatering and ground water production over time and the potential effects to surface and ground water resources in the vicinity of the Project. EML's proposed monitoring program is outlined in Section 2.1.15 and Appendix **C** of this EIS.

■ **Impact 3.2.3.3-2**: The ground water drawdown under the Proposed Action is predicted to be more than ten feet for two perennial stream segments (Roberts Creek and South Fork of Henderson Creek) and at 22 perennial or potentially perennial spring sites (Table 3.2-8) for varying periods of time up to at least 400 years after the end of the mining and milling operations. **Other individual streams and springs outside of the model predictions could also be impacted.**

Significance of the Impact: The impacts are potentially significant at the two stream segments and 22 springs discussed above. Although significant impacts are not predicted to occur in the other individual streams or springs in the HSA due to the Proposed Action, the uncertainty of predicting impacts to streams and springs indicates a need for operational monitoring and mitigation measures to be implemented. If **monitoring, which has been incorporated into the mitigation measure, indicates that** there are reduced flows in perennial stream segments that the BLM determines can be attributed to the mining operation, then **specific** mitigation would be implemented, as described below. **Potential adverse effects to surface water rights would be mitigated under NDWR jurisdiction.**

■ **Mitigation Measure 3.2.3.3-2a:** Specific mitigation for the two perennial stream segments and 22 perennial or potentially perennial spring sites are outlined in Table 3.2-9. **Figure 3.2.21 shows the anticipated location for the components of the facilities necessary to implement the mitigation measures outlined in Table 3.2-9. Implementation of any of the specific mitigation outlined in Table 3.2-9 for springs located on private land would be subject to the authorization of the private land owner. The site-specific evaluation of the effectiveness of this specific mitigation for each identified surface water resource within the mine-related ground water drawdown area is presented in Table 3.2-9. The site-specific measures include one or more methods identified in Mitigation Measure 3.2.3.3-2b. Similar methods (as identified in Table 3.2-9) would also be applied to streams and springs not identified**

in this analysis, if monitoring indicates that there are impacts that the BLM determines can be attributed to the mining operation. Implementation of the mitigation outlined in Table **3.2-9** would result in up to **approximately 37.2** acres of additional surface disturbance associated with **road and** pipeline construction and maintenance**, as well as the need for approximately 302 acre-feet of water that would at least initially come from EML's existing water rights if additional water rights have not yet been secured**. **This specific mitigation would be implemented, as determined by the BLM, based on the results of the monitoring that is also outlined in this mitigation measure.** EML would implement the water monitoring provisions outlined in Section 2.1.15 and Appendix **C** to track the drawdown associated with the open pit dewatering and ground water production activities. In addition, EML would periodically update the ground water flow model as determined by the BLM. EML would be responsible for monitoring and annual reporting of changes in ground water levels and surface water flows prior to and during operation, and for a period of up to 30 years in the post mining and milling phase. **The reports would be in a format and with a content that is acceptable to the BLM. The monitoring outlined in Appendix C and required in this mitigation measure would be used to document the effectiveness of the implemented specific mitigation activities. In addition, the BLM has the ability to require the implementation of additional mitigation measures if the initial implementation is unsuccessful.**

- **Mitigation Measure 3.2.3.3-2b:** If monitoring (Mitigation Measure 3.2.3.3-2a) indicates that flow reductions of perennial surface waters are occurring and that these reductions are likely the result of mine-induced drawdown, the following measures would be implemented:

  1. The BLM would evaluate the available information and determine whether mitigation is required.

  2. If mitigation would be required by the BLM, then EML would be responsible for preparing a detailed, site-specific plan to enhance or replace the impacted perennial water resource(s). Potential adverse effects to water rights from the Project would be mitigated **under** NDWR jurisdiction**, as well as potential need for additional BLM permit acquisition activities and NEPA analysis**. The mitigation plan would be submitted to the BLM identifying the excess amount of drawdown or drawdown impacts to surface water resources. Mitigation would depend on the actual impacts, site-specific conditions, and historical use and could include a variety of measures (e.g., flow augmentation, on-site or off-site improvements). Methods to enhance or replace the impacted perennial water resources include, but are not limited to, the following:

     - Modification**, including cessation,** of pumping distribution in the water supply well field;
     - Injection to confine the drawdown cone;
     - Installation of a water-supply pump in an existing well (e.g., monitoring well);
     - Installation of a new water production well;
     - Piping from a new or existing source;

- Installation of a guzzler;
- Enhanced development of an existing seep or spring to promote additional flow;
- **Water hauling;**
- **Removal of piñon-juniper in impacted watersheds;** or
- Fencing or other protective measures for an existing seep to maintain flow.

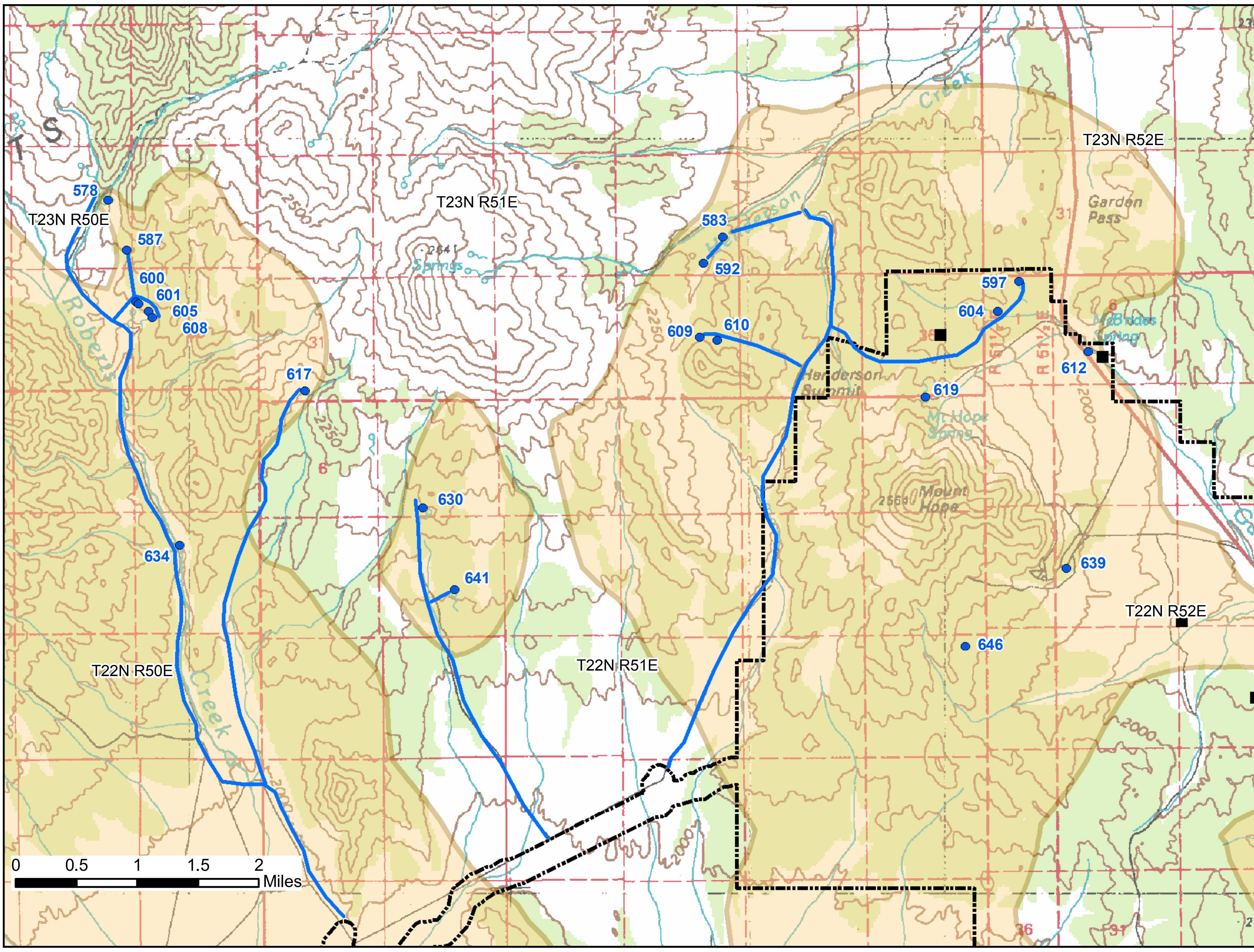
3. An approved site-specific mitigation plan would be implemented followed by monitoring and reporting to measure the effectiveness of the implemented measures.

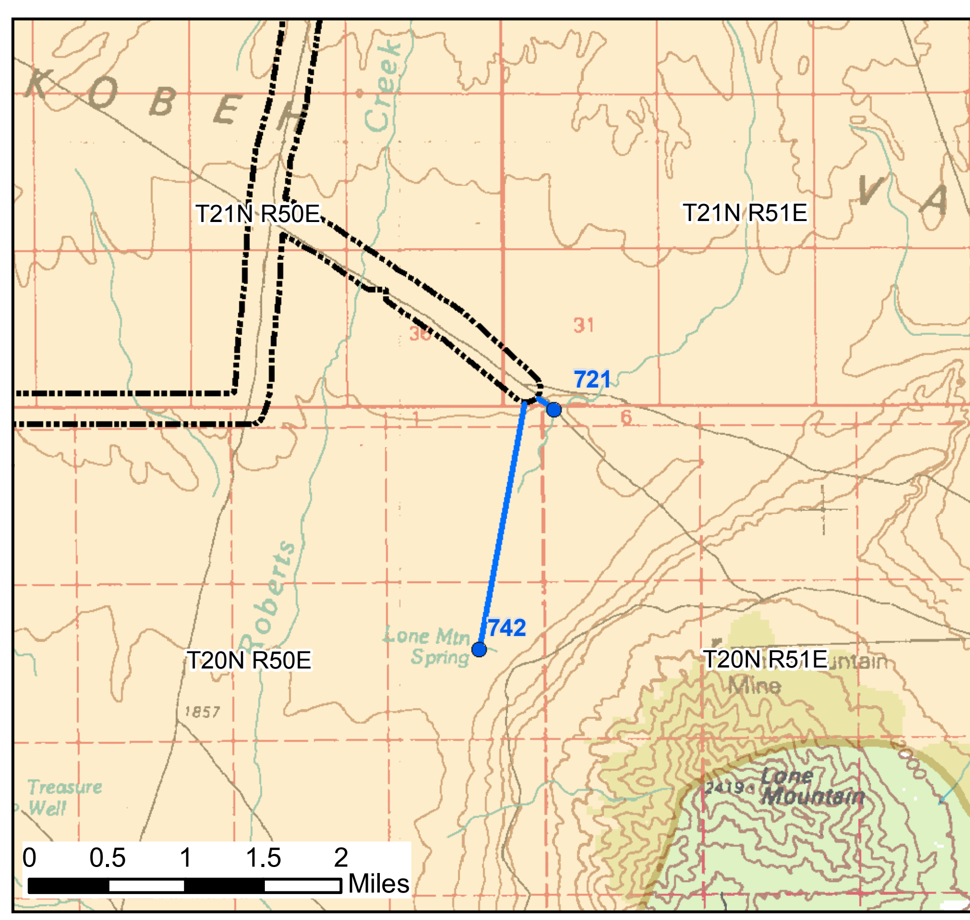
■ **Mitigation Measure 3.2.3.3-2c**: The numerical ground water flow modeling indicates that some impacts to springs may occur after the end of mining and milling operations, when some of the operational measures described above may not be available. For the post-Project delayed impacts of drawdown, the ground water flow model would be updated during the closure process consistent with regulations and policies using the accumulated field data for pumping rates, consumptive use, and observed drawdown within the HSA to re-evaluate projected drawdown that would occur after the end of mining and milling operations. If the BLM determines that the Project impacts perennial stream segments or springs in this post-operational phase, mitigation consisting of one or both of the following measures would be required:

1. Installation of a well and pump at affected stream or spring locations to restore the historic yield of the affected surface water resource.

2. Posting of an additional financial guarantee to provide for potentially affected water supplies in the future.

■ **Effectiveness of Mitigation and Residual Effects:** Mitigation would be designed to address the specific spring or surface water that is affected, which enhances the effectiveness of the mitigation. In addition, a variety of approaches to mitigation can be used within these measures to achieve the objective. These mitigation measures are expected to be effective because the mitigation measures are specifically intended to directly address the impact by restoring or enhancing surface flows, and because the measures would be reviewed and addressed by the BLM. The effectiveness of Mitigation Measure 3.2.3.3-2c, if implemented, is less certain since it would be many decades in the future. If initial implementation was not successful, the BLM may require implementation of additional measures. The feasibility and success of mitigation would depend on site-specific conditions and details of the mitigation plan. However, **this type of mitigation has been proven to be effective and** if measures used in Mitigation Measure 3.2.3.3-2b are implemented, then the measure should be effective at mitigating the impacts from reduced surface water flows. Over a long period of time (tens to **hundreds** of years) the effects to most surface water flows would diminish; however, for the springs nearest to the open pit, flows would be reduced or eliminated in perpetuity.





EXPLANATION

N

- Project Boundary
- 10-Foot Drawdown Maximum Extent
- Impacted Mine Only Springs
- Guzzler Installations
- Pipelines with Existing or New Roads

BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD
CHECKED: -	APPROVED: RFD	DATE: 08/06/2012

FILE NAME: p1635_Fig3-2-21_SurfaceWaterMitigationComponents.mxd

BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Proposed Action Surface Water Mitigation Components

Figure 3.2.21

Table 3.2-9: Surface Water Resources Specific Mitigation

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics (as of the 2011 Site Visit)	Associated Riparian/ Wetland Vegetation (acres)[2]	General Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate) and Affected Resources
578	Unnamed Spring	74.20	This site is an emergent spring with water flowing from the hillside rocks 100 feet upstream to Roberts Creek. This site supports a diverse riparian vegetation community	0.120	Water supply for wildlife, livestock, and wild horses.	**Reduction of** flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-1: Pipe water along an existing road, approximately 7.**1** miles long, from the Project water supply at a sustained rate of approximately 70 gpm.	The mitigation plan for SSMM-1 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses, as well as flows for existing downstream irrigation uses.	Up to approximately **8.6** acres of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, including a limited amount of preliminary priority habitat for greater sage-grouse, air quality impacts, and potential impacts to cultural resources.**
583	Unnamed Spring	5.62	This site is a seep within a channel producing flow down gradient from the source. This site supports a riparian vegetation community.	0.030	Water supply for wildlife and wild horses with limited livestock use.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-2: Pipe water along an existing road, approximately **5.5** miles long, from the Project water supply at a sustained rate of approximately five gpm.	The mitigation plan for SSMM-2 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses, as well as flows for existing downstream irrigation uses.	Up to approximately **6.7** acres of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, including a limited amount of preliminary priority habitat for greater sage-grouse, air quality impacts, and potential**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics (as of the 2011 Site Visit)	Associated Riparian/ Wetland Vegetation (acres)[2]	General Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate) and Affected Resources
									impacts to cultural resources.
587	Unnamed Spring	0.00	This site is a seep that contains ponded standing water within hoof depressions only. Moderate hummocking was observed. The riparian vegetation community is present. An old fenceline runs through the middle of the site with fence posts remaining.	0.110	Water supply for wildlife, livestock, and wild horses.	Reduction of hydrophilic vegetation below established threshold coincident with a reduction in ground water levels in this area, as determined from ground water monitoring	SSMM-3: Pipe water along a new road, approximately 0.3 mile long, from the pipeline to spring 578 at a sustained rate of approximately 0.5 gpm.	The mitigation plan for SSMM-3 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 0.7 acre of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics (as of the 2011 Site Visit)	Associated Riparian/ Wetland Vegetation (acres)[2]	General Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate) and Affected Resources
592	Unnamed Spring (OT-2)	11.90	This site is a seep with saturated soil, but not contributing flow into the drainage. This site supports a riparian vegetation community.	0.250	Water supply for wildlife and wild horses with limited livestock use.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-4: Pipe water along an existing road, approximately 0.3 mile long, from the pipeline to spring 583 at a sustained rate of approximately 0.5 gpm.	The mitigation plan for SSMM-4 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 0.7 acre of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**
597	Garden Spring	0.00	This site consists of two adjacent ponded sources of water. There is piping and an old trough downgradient of the sites that is no longer functioning. Riparian vegetation is supported by these sites.	0.020	Water supply for wildlife, livestock, and wild horses.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-5: Pipe water along an existing and new road, approximately **1.5** miles long, from the pipeline to spring 583 at a sustained rate of approximately 0.5 gpm.	The mitigation plan for SSMM-5 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately **1.8** acres of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, including a limited amount of preliminary priority habitat for greater sage-grouse, air quality impacts, and potential impacts to cultural resources.**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics (as of the 2011 Site Visit)	Associated Riparian/ Wetland Vegetation (acres)[2]	General Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate) and Affected Resources
600	Unnamed Spring	0.00	This site is a seep located in an aspen stand. Flow from this site combines with flow from site 601 (to the east) and flows into a spring/meadow complex. Riparian vegetation is supported by this site.	2.360	Water supply for wildlife, livestock, and wild horses.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-6: Pipe water along an existing road, approximately 0.2 mile long, from the pipeline to spring 578 at a sustained rate of approximately 0.5 gpm.	The mitigation plan for SSMM-6 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 0.**3** acre of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**
601	Unnamed Spring	6.80	This site is a seep located in an aspen stand. Flow from this site combines with flow from site 600 (to the west) and flows into a spring/meadow complex. Riparian vegetation is supported by this site.	0.00*	Water supply for wildlife, livestock, and wild horses.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-7: Pipe water along an existing road, approximately 0.03 mile long, from the pipeline to spring 600 at a sustained rate of approximately 0.5 gpm.	The mitigation plan for SSMM-7 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 0.**1** acre of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics (as of the 2011 Site Visit)	Associated Riparian/ Wetland Vegetation (acres)[2]	General Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate) and Affected Resources
604	Unnamed Spring	0.00	This site consists of a man-made pond. The site has little riparian vegetation around the edge of the pond.	0.060	Water supply and riparian habitat for wildlife, livestock, and wild horses.	Reduction of hydrophilic vegetation below established threshold coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-8: Pipe water along an existing road, approximately 0.1 mile long, from the pipeline to spring 597 at a sustained rate of approximately 0.5 gpm.	The mitigation plan for SSMM-8 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 0.**1** acre of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, including a limited amount of preliminary priority habitat for greater sage-grouse, air quality impacts, and potential impacts to cultural resources.**
605	Unnamed Spring	4.40	This site is part of a four spring complex with two channels flowing and is surrounded by Site 600, Site 601, and Site 608. These four sites are connected by riparian vegetation. Flow leaves the site in two separate channels. Riparian vegetation is present at this site.	0.00*	Water supply for wildlife, livestock, and wild horses.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-9: Pipe water along an existing road, approximately 0.1 mile long, from the pipeline to spring 601 at a sustained rate of approximately 0.5 gpm.	The mitigation plan for SSMM-9 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 0.2 acre of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics (as of the 2011 Site Visit)	Associated Riparian/ Wetland Vegetation (acres)[2]	General Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate) and Affected Resources
608	Unnamed Spring	4.20	This site is part of a four spring complex and consists of a saturated area with flow forming in the channel below. Riparian vegetation is supported at this site	0.00*	Water supply for wildlife, livestock, and wild horses.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-10: Pipe water along an existing road, approximately 0.06 mile long, from the pipeline to spring 605 at a sustained rate of approximately 0.5 gpm.	The mitigation plan for SSMM-10 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 0.1 acre of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**
609	Unnamed Spring (OT-5)	0.06	This site consists of a seeping area with a man-made berm to create a pond. There is flow from the seeping area into the pond, but no flow is leaving the pond. Riparian vegetation is supported at this site.	0.170	Water supply for wild horses with limited livestock use.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-11: Pipe water along an existing road, approximately 1.0 mile long, from the pipeline to spring 583 at a sustained rate of approximately 0.5 gpm.	The mitigation plan for SSMM-11 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 1.2 acres of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics (as of the 2011 Site Visit)	Associated Riparian/ Wetland Vegetation (acres)[2]	General Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate) and Affected Resources
610	Unnamed Spring (OT-3)	1.40	This site consists of a spring flowing into a pond created by a man-made berm. Water also flows from the man-made pond. Riparian vegetation is supported at this site.	0.120	Limited use as a water supply for wildlife, livestock, and wild horses.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-12: **Pipe water along an existing road, approximately 0.1 mile long, from the pipeline to spring 609 at a sustained rate of approximately 1.0 gpm.**	Mitigation plan for SSMM-12 would be highly effective at maintaining a water supply for wildlife.	Approximately 0.**2** acre of new surface disturbance for **the water pipeline**. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**
612	McBrides Spring[4]	0.35	The site is a spring that has been developed with a valve box and water trough. Flow to the trough is controlled by a valve. There is no riparian vegetation at this site.	0.000	Perennial water supply for livestock, wildlife, and wild horses.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-13: Install a guzzler designed for large game.	Mitigation plan SSMM-13 would be highly effective at maintaining a water supply for wildlife.	Approximately 0.7 acre of new surface disturbance for guzzler installation. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, including preliminary general habitat for greater sage-grouse, air quality impacts, and potential impacts to cultural resources.**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics (as of the 2011 Site Visit)	Associated Riparian/ Wetland Vegetation (acres)[2]	General Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate) and Affected Resources
617	Unnamed Spring	0.00	This site consists of an area saturated by a seep. There is no flow at this site. Riparian vegetation is supported at this site.	0.110	Water supply and riparian habitat for wildlife and wild horses, and limited livestock use.	Reduction of hydrophilic vegetation below established threshold coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-14: Pipe water along an existing road, approximately **3.1** miles long, from the pipeline to spring 578 at a sustained rate of approximately 0.5 gpm.	The mitigation plan for SSMM-14 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately **3.8** acres of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, including a limited amount of preliminary priority habitat for greater sage-grouse, air quality impacts, and potential impacts to cultural resources.**
619	Mount Hope Spring[4]	0.03	This site is a low-flow spring that has been developed with a trough. There is no riparian vegetation at this site.	0.000	Wildlife and wild horses.	Prior to the construction of the Project fence.	SSMM-15: Install a guzzler north of the Project fence designed for large game.	Mitigation plan for SSMM-15 would be highly effective at maintaining a water supply for wildlife.	Approximately 0.7 acre of new surface disturbance for guzzler installation. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics (as of the 2011 Site Visit)	Associated Riparian/ Wetland Vegetation (acres)[2]	General Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate) and Affected Resources
630	Unnamed Spring (OT-8)	7.31	This site consists of a spring that has been partially developed with piping. Water is piped from the source to a bermed ponded area holding water then into a second bermed ponded area. The site is partially fenced. Riparian vegetation is supported at this site.	0.080	Water supply for wild horses with limited livestock use.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-16: Pipe water along an existing road, approximately 3.2 miles long, from the Project water supply at a sustained rate of approximately seven gpm.	The mitigation plan for SSMM-16 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 3.9 acres of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, including preliminary priority and general habitat for greater sage-grouse, air quality impacts, and potential impacts to cultural resources.**
634	Farrington Spring	1.10	This site consists of a bank seep adding flow to the drainage. Riparian vegetation is supported by this site.	0.001	Water supply for wild horses with limited livestock use.	Any mitigation for this site would be addressed and covered under the mitigation for Roberts Creek. See SSMM-22.	**SSMM-17: Pipe water along an existing road, approximately 0.1 mile long, from the pipeline to spring 578 at a sustained rate of approximately 1.0 gpm.**	**The mitigation plan for SSMM-17 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.**	**Up to approximately 0.2 acre of new surface disturbance for the installation and maintenance of the water pipeline. This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics (as of the 2011 Site Visit)	Associated Riparian/ Wetland Vegetation (acres)[2]	General Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate) and Affected Resources
639	Zinc Adit	2.00	This site consists of water flowing from underground workings. The site supports an area of saturated soils and sparse riparian vegetation.	0.120	Water supply for wild horses with limited livestock use.	Prior to the construction of the Project fence.	SSMM-1**8**: Install a guzzler east of the Project fence and west of SR 278 designed for large game.	Mitigation plan for SSMM-1**8** would be highly effective at maintaining a water supply for wildlife.	Approximately 0.7 acre of new surface disturbance for guzzler installation. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, including preliminary general habitat for greater sage-grouse, air quality impacts, and potential impacts to cultural resources.**
641	Unnamed Spring (OT-7)	2.70	This site is a spring contained with the aid of earthen berms to form ponds. There is non-functioning piping present at the site. Riparian vegetation is supported at the site.	0.290	Water supply for wild horses with limited livestock use.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-1**9**: Pipe water along a new road, approximately 0.2 mile long, from the pipeline to spring 630 at a sustained rate of approximately two gpm.	The mitigation plan for SSMM-1 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 0.1 acre of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, including preliminary general habitat for greater sage-grouse, air quality impacts, and potential impacts to cultural resources.**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics (as of the 2011 Site Visit)	Associated Riparian/ Wetland Vegetation (acres)[2]	General Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate) and Affected Resources
646	Unnamed Spring (SP-7)	0.00	This site is a ponded spring with no flow. Riparian vegetation is present at this site.	0.000	Perennial water supply for livestock, wildlife, and wild horses**.**	Prior to the construction of the Project fence.	SSMM-**20**: Install a guzzler east of the Project fence and west of SR 278 designed for large game.	Mitigation plan for SSMM-**20** would be highly effective at maintaining a water supply for wildlife.	Approximately 0.7 acre of new surface disturbance for guzzler installation. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, including preliminary general habitat for greater sage-grouse, air quality impacts, and potential impacts to cultural resources.**
721	Mud Spring	0.00	This site consists of a spring emerging from the alluvium creating a pond in the valley. Riparian vegetation is supported at this site.	0.310	Water supply for wild horses with limited livestock use.	**This impact is likely to occur shortly after ground water production begins. Six months after wellfield production begins.**	SSMM-2**1**: Pipe water along an existing road, approximately 0.**1** mile long, from the Project water supply at a sustained rate of approximately 0.5 gpm.	The mitigation plan for SSMM-2**1** would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 0.**2** acre of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, including preliminary priority habitat for greater sage-grouse, air quality impacts, and potential impacts to cultural resources.**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics (as of the 2011 Site Visit)	Associated Riparian/ Wetland Vegetation (acres)[2]	General Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate) and Affected Resources
742	Lone Mountain Spring (KV035)	0.00	This site consists of a spring emerging from the alluvium creating a pond in the valley. Riparian vegetation is supported at this site.	0.200	Water supply for wild horses with limited livestock use.	**This impact is likely to occur shortly after ground water production begins. Six months after wellfield production begins.**	SSMM-2**2**: Pipe water along a new road, approximately 1.**4** miles long, from the Project water supply at a sustained rate of approximately 0.5 gpm.	The mitigation plan for SSMM-2**2** would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 3.**5** acres of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, including preliminary priority habitat for greater sage-grouse, air quality impacts, and potential impacts to cultural resources.**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics (as of the 2011 Site Visit)	Associated Riparian/ Wetland Vegetation (acres)[2]	General Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate) and Affected Resources
--	Roberts Creek[4]	**168**[6]		*[5]	Perennial water supply for irrigation, livestock, wildlife, and wild horses**.**	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-2**3**: Pipe water from the Project water supply at a minimum sustained rate of approximately **170** gpm. The supple**m**ental flows would be discharged to the stream at multiple locations, as determined by the BLM. The pipeline under SSMM-1 would be utilized for this mitigation measure.	The mitigation plan for SSMM-2**3** would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses, as well as flows for existing downstream irrigation uses.	Up to approximately one acre of new surface disturbance for the installation and maintenance of the water pipeline. The pipeline under SSMM-1 would be utilized for this mitigation measure. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics (as of the 2011 Site Visit)	Associated Riparian/ Wetland Vegetation (acres)[2]	General Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate) and Affected Resources
--	Henderson Creek[4]	**40**[6]		*[5]	Perennial water supply for irrigation, livestock, wildlife, and wild horses.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-2**4**: Pipe water from the Project water supply at a minimum sustained rate of approximately **4**0 gpm. The supplemental flows would be discharged to the stream at multiple locations, as determined by the BLM. The pipeline under SSMM-2 would be utilized for this mitigation measure.	The mitigation plan for SSMM-2**4** would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses, as well as flows for existing downstream irrigation uses.	Up to approximately one acre of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**

[1]All flow data in this table from JBR 2011, unless otherwise noted

[2]All acreage data in this table from JBR 2011, unless otherwise noted

[3]Disturbance areas would be managed and reclaimed in accordance with BLM and State of Nevada requirements.

[4]Flows from Montgomery et al. 2010

[5]The riparian areas along the creeks have not been mapped in detail.

[6]Data from Interflow 2012

3.2.3.3.2 Ground Water Resources

Lowering of the Water Table

The dewatering associated with the proposed open pit mining would lower the bedrock ground water elevations by approximately 2,250 feet in the vicinity of the open pit during mining operations. At the same time, and continuing for 12 years after the end of pit dewatering, pumping in the KVCWF for process water supply would lower the water table in the basin-fill and bedrock aquifers of central Kobeh Valley and the southern part of the Roberts Mountains. Based on numerical ground water flow modeling, the expected amount of drawdown near the center of the KVCWF is approximately 120 feet after 44 years of pumping under the Proposed Action (Montgomery et al. 2010). The ground water levels in the areas of the open pit and the KVCWF would begin to recover immediately after Project-related dewatering and pumping cease. The Regional Model was used to evaluate water level recovery for a post-Project period of 400 years, whereas the post-Project recovery time frame simulated with the Local Model was 1,580 years. The longer period simulated with the Local Model exceeded the time required for ground water recovery in the pit area and for pit lake formation, but was completed to ensure that equilibrium conditions had been achieved for the pit lake (Figure 3.2.2**2**).

<u>Impacts to Ground Water Resources</u>

Potential impacts to ground water resources and thus the associated ground water users within the area affected by drawdown were evaluated based on the ground water flow modeling results. Such impacts may involve lowering of ground water levels at wells. The Regional Model was used to evaluate potential impacts to wells, in addition to the surface water resources discussed above in Section 3.2.3.3.1. The evaluation of drawdown considered modeling results at eight different points in time: at the end of mining and milling operations (in 2055), and at ten, 30, 50, 100, 200, 300, and 400 years post-Project.

For the purpose of this analysis, all water rights owned or controlled by EML as of July 1, 2011, were excluded from consideration. As shown in Table 3.2-6 and Figure 3.2.20, there are seven wells located within the simulated mine-induced drawdown area (i.e., area where the ground water levels are predicted to be lowered by ten feet or more as a result of the mine st**ock**watering and well field pumping activities under the Proposed Action) that are not associated with EML water rights.

In addition to the seven wells with associated ground water rights located within the simulated mine-induced drawdown area, there also are two wells (Wells 204 and 310) used for stock watering that do not have associated water rights. As shown in Table 3.2-7, the magnitude, timing, and duration of the predicted drawdown varies for these different locations. Based on the modeling results, all of the nine wells are predicted to experience recovery of ground water levels resulting in less than ten feet of drawdown within 100 years post-Project. In addition, there is a domestic water well at the Roberts Creek Ranch that is within the ten-foot drawdown contour. Further, Nevada water law allows for one domestic water well per private parcel; therefore, there is a potential for additional undocumented (not filed with the NDWR) domestic water wells affected by the drawdown because they are within the ten-foot drawdown cone of depression. Impacts to, and mitigation for, water rights are **under** the jurisdiction of the NDWR. **The BLM would not address or mitigate impacts to water rights.**

Changes to water levels at the location of the seven wells with associated **active** ground water **use with water** rights listed in Table 3.2-10 are considered to be significant under the Proposed Action because the associated wells are used or could be used to produce water, and because they are thought to be hydraulically connected to the basin-fill and bedrock aquifers affected by drawdown. Changes to water levels at the locations of the two additional stockwatering wells listed in Table 3.2-10 are not deemed significant because neither one is associated with a valid and active water right.

- **Impact 3.2.3.3-3:** The ground water drawdown is predicted to exceed ten feet at the locations of seven wells with associated **active** ground water **use with water** rights.

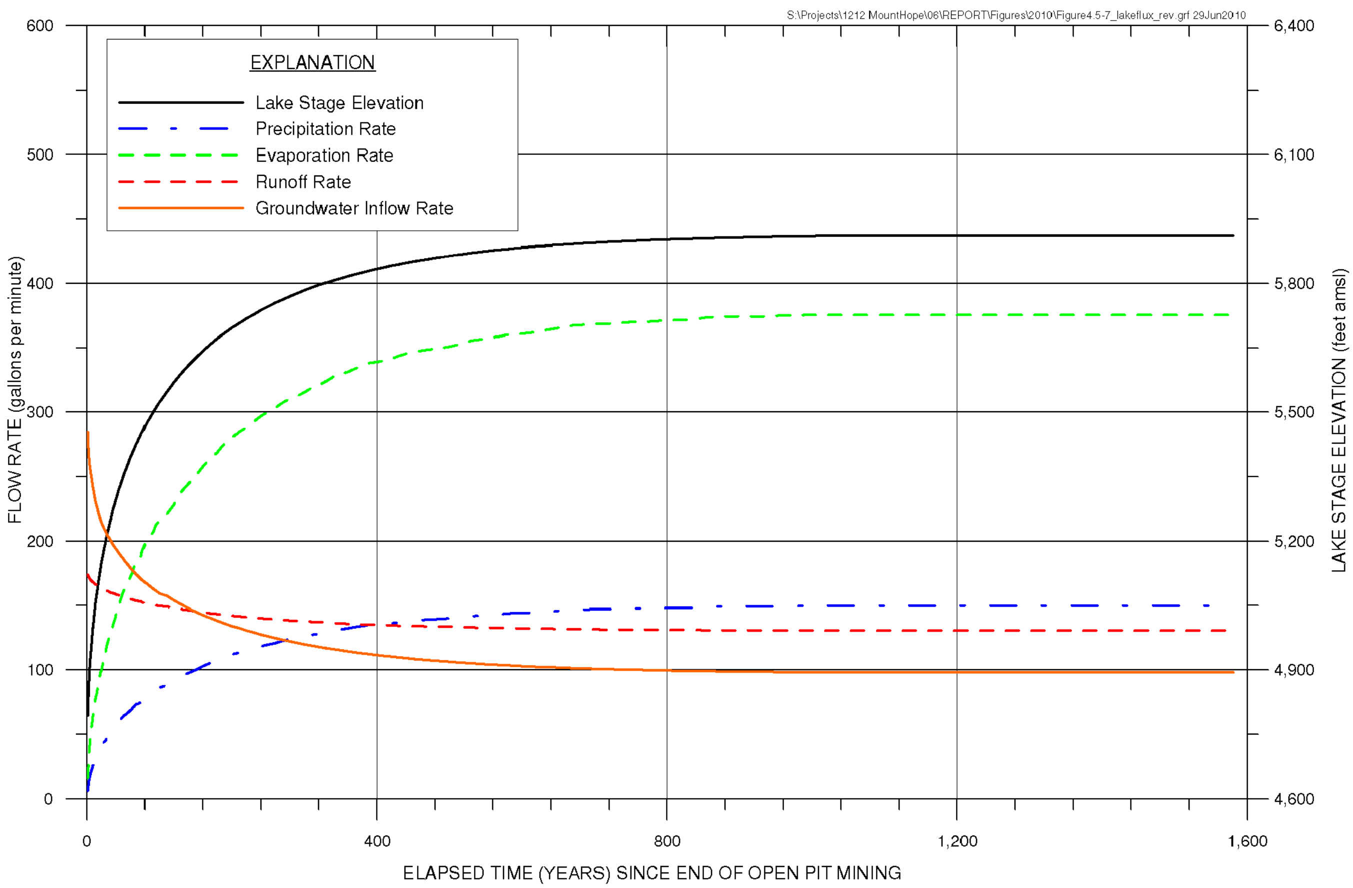
  Significance of the Impact: Impacts to the seven wells with associated ground water **use with water** rights listed in Table 3.2-10 are potentially significant until such time as the ground water level recovers to less than ten feet of drawdown, which is predicted to be less than 100 years post-Project in all cases. The impacts would become less than significant after implementation of the mitigation measures described below. Potential adverse effects to ground water rights would be mitigated **under NDWR. Therefore, no mitigation measures are proposed by the BLM for ground water rights. Section 3.26 includes suggested mitigation outside the BLM's jurisdiction for water rights.**

Table 3.2-10: Estimated Water Level Change at Ground Water Rights and Wells that May be Affected by Project Activities

Water Right Permit Number	Well Inventory Number	Years After End of Dewatering and KVCWF Pumping (drawdown in feet)							
		0	10	30	50	100	200	300	400
43025	123	42	34	22	15	6	3	1	1
44774	292	10	13	14	13	7	5	1	1
44775	218	30	30	23	17	7	4	1	1
47907	317	12	11	10	10	9	9	9	8
48684	162	18	19	15	12	5	3	1	1
71594	127	13	15	14	10	4	2	1	1
11188, R06952	494	12	10	7	5	2	1	<1	<1
-	204	8	10	11	11	6	4	1	1
-	310	69	46	28	19	8	5	1	1

Note: Does not include ground water rights or wells owned or controlled by EML as of July 1, 2011.
Source: Montgomery et al. (2010)

- **Mitigation Measure 3.2.3.3-3a:** For the seven wells with associated **active** ground water **use with water** rights EML would assess the distance of the screened interval and the pumping below the ground water table. If that difference is greater than maximum predicted drawdown, then EML would pay the water right holder for the increase in pumping costs based on historical usage. If the difference is greater than ten feet, then EML would pay for either the lowering of the pump to a depth greater than the maximum drawdown in the well, or the completion of a new well with the screened depth greater



BATTLE MOUNTAIN DISTRICT OFFICE Mount Lewis Field Office 50 Bastian Road Battle Mountain, Nevada 89820			BUREAU OF LAND MANAGEMENT MOUNT HOPE PROJECT	DRAWING TITLE: **Rate of Pit Lake Development Under the Proposed Action** **Figure 3.2.22**
DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD		
CHECKED: -	APPROVED: RFD	DATE: 08/03/2012		
FILE NAME: p1635_Fig3-2-X_Hydro_8i11i.mxd				

than the maximum predicted drawdown and pay the water right holder for the increase in pumping costs based on historic usage. In addition, EML would implement the water monitoring provisions outlined in Section 2.1.15 and in Appendix **C**. If, through implementation of the water monitoring, it is determined that there are impacts to wells with associated **active** ground water **use with water** rights attributable to the Project, whether predicted or not, then the following mitigation measures would be implemented.

- **Mitigation Measure 3.2.3.3-3b:** If monitoring (Mitigation Measure 3.2.3.3-3a) indicates that mine-induced drawdown impacts a well with associated **active** water **use with** rights, the following measures would be implemented:

    1. The BLM would evaluate the available information and **if the drawdown can be attributed to impacts from the Project, the mitigation described above would be required**.

    2. If mitigation is required by the BLM, then EML would be responsible for preparing a detailed, site-specific plan to enhance or replace the impacted ground water. The mitigation plan would be submitted to the BLM identifying drawdown impacts to ground water resources. Mitigation would depend on the actual impacts and site-specific conditions and could include the following:

        - Lowering the pump in an existing well;
        - Deepening an existing well;
        - Drilling a new well for replacement of water supply;
        - Providing a replacement water supply of equivalent yield and general water quality;
        - Pay for any incremental increase in pumping costs.
        - Modifying the KVCWF pumping regime (well locations or rates) during operations to reduce drawdown in the area of the impacted ground water resources;
        - Infiltrating or injecting water during operations at strategic locations to limit drawdown propagation in certain areas.

    3. An approved site-specific mitigation plan would be implemented followed by monitoring and reporting to measure the effectiveness of the implemented measures.

- **Mitigation Measure 3.2.3.3-3c**: For any significant impacts to wells with associated **active** ground water **use with water** rights that do not occur until after the end of mining and milling operations, the operational measures described above may not be available. For the post-Project delayed impacts of drawdown, the ground water flow model would be updated during the closure process consistent with regulations and policies using the accumulated field data for pumping rates, consumptive use, and observed drawdown within the HSA to re-evaluate projected drawdown that would occur after the end of mining and milling operations. Wells **with** associated active ground water **use with water** rights not owned or controlled by EML that are indicated to be significantly impacted would then be mitigated by **EML using** one or more of the following measures, as directed by the BLM:

1. Installation of a deeper well and pump at affected locations to restore the historical yield of the well (including incremental increase in pumping costs).

2. Posting of a funding mechanism to provide for potential future impacts to potentially affected water **sources**.

- **Effectiveness of Mitigation and Residual Effects:** Implementation of Mitigation Measure 3.2.3.3-3b and the use of any of the options outlined above would be effective at mitigating the impacts to **wells with associated active** ground water **use with water** rights. Mitigation would be designed to address the specific ground water source that is affected, which enhances the effectiveness of the mitigation. Because the mitigation measures are specifically intended to directly address the impact by providing financial compensation or ensuring that the water is made available, and because the measures **would** be reviewed and assessed by the BLM, these mitigation measures are expected to be effective. If initial implementation were unsuccessful, the BLM may require implementation of additional measures. The feasibility and success of mitigation would depend on site-specific conditions and details of the mitigation plan. Any residual effects to ground water **uses** would be fully mitigated and over a long period of time (tens to **hundreds** of years) the drawdown effects would fully diminish, except in the vicinity of the open pit where the effects would be in perpetuity.

Impacts to Basin Water Budgets

The water balance for the ground water system within the HSA was estimated using the calibrated ground water flow model (Montgomery et al. 2010) and the mine dewatering and consumptive use assumptions for the Cumulative Action Scenario and the No Action Alternative, as described in Section 3.2.3.2. The water budget changes attributable to the Proposed Action were derived from these results by using the same subtraction procedure that was used in the drawdown analysis, as described in Section 3.2.3.2.4. For comparison, the estimated annual ground water inflow and outflow rates under the baseline condition (2009) are summarized in Table 3.2-5. Projected future changes to the various components of the water budget under the Proposed Action are summarized for the final year of mining and milling operations and for 50 years after all mine-related pumping has ceased in Tables 3.2-11 and 3.2-12, respectively; the projected future changes due to the Proposed Action were estimated relative to the No Action Alternative water budgets at the same points in time (see Section 3.2.3.4.2). The estimated water budgets and net changes in total inflow and outflow reflect changes in storage and fluctuations of the major inflow and outflow components over time resulting from mine pit dewatering and KVCWF pumping.

The estimated changes in annual ground water budgets under the Proposed Action indicate that the mine-induced drawdown associated with pit dewatering and KVCWF pumping is predicted to result in a decrease in **ET** in all basins of the HSA. Most of the predicted decrease (95 percent at 50 years after the end of mine-related pumping) in **ET** within the HSA occurs in Kobeh Valley. The predicted water table drawdown in Kobeh Valley extends to the mapped phreatophyte areas northwest of Bean Flat and east of Lone Mountain (Figure 3.2.20). The predominant phreatophyte vegetation in these areas is greasewood. The simulated extinction depth for greasewood is 40 feet below the ground surface, and the ground water model results indicate that the magnitude of drawdown along the perimeter of these phreatophyte vegetation areas would exceed the extinction depth for some period of time (Montgomery et al. 2010). This could potentially lead to a decrease in the number and density of phreatophyte plants and an associated decrease in **ET** of ground water, as reflected in the estimated water budget changes listed in Tables 3.2-11 and 3.2-12.

Table 3.2-11: Estimated Change in Annual Ground Water Budgets in Final Year of Project (2055) Under the Proposed Action, Relative to the No Action Alternative[1]

Budget Component	Antelope Valley	Diamond Valley	Kobeh Valley	Pine Valley (within the HSA)	Entire HSA
Change in Ground Water Inflow[2] (afy)					
Precipitation Recharge	0	**-226**	**-38**	0	0
Subsurface Inflow[4]	0	70 (55 from Pine Valley and 15 from Kobeh Valley)	201 (1 from Monitor Valley, 33 from Antelope Valley, and 167 from Pine Valley)	0	1 (from Monitor Valley to Kobeh Valley)
Net Change in Total Inflow	**0**	**-156**	**163**	**0**	**1**
Change in Ground Water Outflow[2] (afy)					
Evapotranspiration[3,4]	-16	-52	-4,015	-11	-4,094
Net Ground Water Pumping[5]	0	0	11,300	0	11,300
Subsurface Outflow[4]	33 (to Kobeh Valley)	0	15 (to Diamond Valley)	222 (55 to Diamond Valley and 167 to Kobeh Valley)	0
Net Change in Total Outflow	**17**	**-52**	**7,285**	**211**	**7,206**

1 Estimation based on sources of data and methods described in Montgomery et al. (2010), including results from the calibrated numerical ground water model.
2 Positive values indicate increase and negative values indicate decrease in water budget component or in net change in total inflow and outflow.
3 Includes ET from phreatophyte areas and evaporation from playas and spring discharge.
4 Source: Montgomery et al. (2010), Table 4.4-7.
5 Source: Montgomery et al. (2010), Figure 4.4-2.

In the final year of operations under the Proposed Action (2055), the estimated available ground water in Diamond Valley is predicted to be reduced by 52 afy as a result of open pit dewatering and KVCWF pumping, relative to the No Action Alternative at that same point in time (Table 3.2-11). An increase in subsurface inflow to Diamond Valley of 70 afy (55 afy from Pine Valley and 15 afy from Kobeh Valley) also is predicted to occur as a result of open pit dewatering (since the pit is mostly located within the Diamond Valley basin), but because that water would be pumped and consumptively used by the mine under the Proposed Action, it would not contribute to the available ground water in Diamond Valley. Fifty years after the end of operations under the Proposed Action (2105), the estimated available ground water in

Diamond Valley is predicted to be reduced by 65 afy as a result of pit lake capture and previous KVCWF pumping, relative to the No Action Alternative at that same point in time (Table 3.2-12). In 2105, a predicted increase in subsurface inflow to Diamond Valley of 42 afy (40 afy from Pine Valley and two afy from Kobeh Valley) results from pit lake capture. The captured water either would be stored in the pit lake or lost to evaporation, so the water would not contribute to the available ground water in Diamond Valley. The predicted mine-related reduction in available ground water in Diamond Valley within 50 years post-Project under the Proposed Action (up to 65 afy) is minor (0.1 percent) in comparison to the estimated consumptive use of ground water for agricultural purposes in Diamond Valley (55,800 afy) in 2009.

Table 3.2-12: Estimated Change in Annual Ground Water Budgets 50 Years Post-Project (2105) Under the Proposed Action, Relative to the No Action Alternative[1]

Budget Component	Antelope Valley	Diamond Valley	Kobeh Valley	Pine Valley (within the HSA)	Entire HSA
Change in Ground Water Inflow[2] (afy)					
Precipitation Recharge	0	0	0	0	0
Subsurface Inflow[4]	0	42 (40 from Pine Valley and 2 from Kobeh Valley)	189 (13 from Monitor Valley, 38 from Antelope Valley, and 138 from Pine Valley)	0	13 (from Monitor Valley to Kobeh Valley)
Net Change in Total Inflow	**0**	**42**	**189**	**0**	**13**
Change in Ground Water Outflow[2] (afy)					
Evapotranspiration[3,4]	-30	-65	-2,314	-35	-2,444
Net Ground Water Pumping	0	0	0	0	0
Subsurface Outflow[4]	38 (to Kobeh Valley)	0	2 (to Diamond Valley)	178 (40 to Diamond Valley and 138 to Kobeh Valley)	0
Net Change in Total Outflow	**8**	**-65**	**-2,312**	**143**	**-2,444**

1 Estimation based on sources of data and methods described in Montgomery et al. (2010), including results from the calibrated numerical ground water model.
2 Positive values indicate increase and negative values indicate decrease in water budget component or in net change in total inflow and outflow.
3 Includes ET from phreatophyte areas and evaporation from playas and spring discharge.
4 Source: Montgomery et al. (2010), Table 4.4-7.

The quantity of ground water leaving the HSA by subsurface flow and discharging into northern Pine Valley (the only location of subsurface outflow from the HSA) is not predicted to change significantly as a result of mine dewatering and KVCWF pumping.

- **Impact 3.2.3.3-4:** Ground water flow modeling indicates that there could be up to approximately a 25 percent decrease in **ET** of ground water in Kobeh Valley due to phreatophyte plant reduction resulting from temporary mine-induced drawdown.

  Significance of the Impact: The impact is not considered significant.

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

- **Impact 3.2.3.3-5:** Ground water flow modeling indicates that there could be a time-varying net change (decrease or increase) in the available ground water in Diamond Valley that is due solely to effects of the Proposed Action by the end of mining and milling operations and for at least 50 years post-Project; however, the magnitude of the predicted changes are less than 0.1 percent, compared to the overall ground water budget for Diamond Valley.

  Significance of the Impact: The impact is not considered significant.

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

<u>Consumptive Losses</u>

Open pit dewatering and KVCWF pumping under the Proposed Action would constitute a combined maximum consumptive water use of 11,300 afy during the 44-year period of mining and milling operations. This consumptive use would cease at the end of that time period. After mining operations cease and the pit lake begins to fill, some pit lake water would be consumptively lost due to evaporation. The evaporative loss would increase over time with the increasing pit lake stage and water surface area after mine closure, but it would be divided between the various sources of water filling the pit (i.e., direct precipitation, pit-area runoff, and ground water inflow). For the Proposed Action after 100 years of pit filling, the consumptive loss of ground water due to pit lake evaporation is predicted to be approximately 165 gpm **(266 afy)** (Figure 3.2.2**2**); after 800 years of pit filling a steady, long-term ground water loss of approximately 100 gpm (161 afy) is predicted. At all times during the simulated recovery period (through 1,580 years after mining and milling operations cease), including at final equilibrium, the hydraulic gradients are inward toward the pit in all directions, indicating that the pit consistently acts as a hydraulic sink during and after mine closure (Montgomery et al. 2010). The 161 afy is less than 0.1 percent of the water budget for Kobeh and Diamond Valleys combined.

The Pine Valley, Diamond Valley, and Kobeh Valley hydrographic areas are classified as designated basins by the NDWR and the withdrawal and use of ground water is regulated. Evaporative losses of approximately 161 afy may be treated as a consumptive use and accounted for as a water right at the discretion of the Nevada State Engineer. The resulting annual volume of water is comparable to the annual water use allowed for a land parcel of equivalent area placed under irrigation.

- **Impact 3.2.3.3-6:** Consumptive use of water during mining and milling operations would support a beneficial use and would not be expected to adversely impact water resources. Long-term consumptive use of ground water by evaporation from the pit lake surface is predicted to be approximately 100 gpm (161 afy) and would continue in perpetuity. This consumptive loss would only occur under the Proposed Action (and the Off-Site Transfer of Ore Concentrate for Processing Alternative and the Slower, Longer Project Alternative), and so represents a negative impact compared to the No Action Alternative.

  Significance of the Impact: Impacts during mining and milling operations are less than significant. After those operations cease, direct impacts of pit lake evaporation do not result in significant impacts.

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Potential Impacts Due to Subsidence

The land surface above an aquifer has the potential to subside when ground water is removed from an aquifer composed of unconsolidated fine-grained sediment, which undergoes consolidation due to the reduction in fluid pressure associated with fluid loss. The most extensive subsidence typically occurs in unconsolidated material containing fine-grained sediments that are interbedded with sand and gravel aquifers. No subsidence would occur due to dewatering of the bedrock aquifers because the rock is generally competent (load bearing). The amount of consolidation is greater in the fine-grained sediments (clays) than in the coarser sand and gravel because of the more collapsible structure of clay beds and because clays contain more fluid per unit volume. When the pressure is reduced by the withdrawal of ground water by dewatering, unconsolidated materials undergo compaction, which is often irreversible. Typically, only a small part of the compression is reversible during ground water level recovery.

An analysis of potential impacts due to subsidence was performed using the Interbed-Storage Package for MODFLOW (Leake and Prudic 1991) along with ground water flow modeling of the No Action Alternative and Cumulative Action Scenarios (described above in Section 3.2.3.3.3). The Proposed Action predicted subsidence was determined using the same procedure that was used to determine water-table drawdown under the Proposed Action (i.e., the No Action Alternative subsidence results were subtracted from the Cumulative Action Scenario results), and the predicted Proposed Action subsidence is presented relative to existing (2009) conditions. The modeled interbed-storage parameters were calibrated to the distribution of subsidence interpreted from InSAR data for the main agricultural area in Diamond Valley from 1992 to 2000, as described in Section 3.2.2.6.6. The hydrogeological characteristics of Diamond and Kobeh Valleys are very similar (Harrill 1968; Tumbusch and Plume 2006). Both valleys contain thick (greater than 3,000 feet) sections of basin fill, much of it related to repeated cycles of lacustrine deposition during the late Cenozoic. It is therefore reasonable to infer that the Kobeh Valley basin-fill aquifer system's response to pumping in the KVCWF area would be similar to that presently occurring in Diamond Valley. Diamond Valley thus provides a useful analogue for estimating future potential impacts due to increased pumping in Kobeh Valley under the Proposed Action (Bell 2008).

The numerical model shows that under the Proposed Action, subsidence of up to approximately 2.5 feet would occur in the northern part of the KVCWF area (Figure 3.2.2**3**). The projected lateral extent of subsidence greater than one-half-foot is approximately four miles in radius and is centered on the northern part of the well field area. There is no other predicted land subsidence due to the effects of mine pit dewatering or KVCWF pumping under the Proposed Action within the HSA.

Potential for Changes to Aquifer Productivity

The greatest potential for permanent deformation would occur in the finer grained sediments (clays and silty clays) that are not the primary water-bearing materials in the basin-fill aquifer of Kobeh Valley. The result would be a slight loss in aquifer interbed storage, but no noticeable loss in aquifer productivity of water supply wells. Thus, the potential impacts to the aquifer due to subsidence under the Proposed Action, if any, would be localized and are not considered significant.

- **Impact 3.2.3.3-7**: A small change in aquifer characteristics is expected to result from compaction of the aquifer materials. Ground subsidence of greater than one-half-foot is projected to extend approximately four miles quasi-radially from the center of subsidence effects in the northern part of the KVCWF area, and a maximum subsidence of approximately 2.5 feet is projected in a small part of that central area. The subsidence would result primarily from a permanent reduction in porosity of the finer grained sediments (clays and silty clays), which are not the primary water-bearing materials in the basin-fill aquifer.

  Significance of the Impact: The potential for the Kobeh Valley basin-fill aquifer to transmit or store water is not expected to be significantly impacted**.**

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Potential for Significant Land Surface Alteration

Consolidation of sediments that results in subsidence could also produce changes at the land surface. As noted above, ground subsidence of approximately 2.5 feet would occur in a small part of the northern KVCWF area, and subsidence of up to one-half-foot is projected to extend approximately four miles from the center of subsidence effects in the northern well field area. If the future subsidence is smoothly distributed (as simulated by the MODFLOW-based model and the Interbed-Storage Package), it would not be noticeable because the average slopes of the land surface would mask any effects.

However, subsidence is not always smoothly distributed and irregularities in subsidence may occur, which leads to the potential for ground water withdrawals to induce fissures in the basin-fill deposits. Such fissures, thought to be induced by subsidence, have been observed and studied in Crescent Valley (adjacent to Pine Valley on the west side of the Cortez Mountains in the northwest part of the HSA), as documented in BLM (2004). Newly induced fissuring in the basin-fill deposits has the potential to alter surface drainage by causing ponding adjacent to surface breaks, or by deflecting surface runoff to a new course that follows the newly induced fissures. More important is the possibility of deflecting surface runoff directly into openings along the fissures. Fissures induced by subsidence are usually initially too narrow to be readily apparent, but may be substantially enlarged by erosion if exposed to significant overland flow. The erosion could result in deep, wide fissure gullies, which could be a hazard to people and animals. Fissure gullies could also damage roads or mining facilities.

In addition, such fissures may initially be open directly from the land surface to the aquifer, thus creating a shortcut for recharge to the aquifer. If any contaminants entered such a fissure, they would also be afforded a more direct route to the aquifer. Once subsidence stops, such fissures eventually naturally fill with sediment, but the natural process could take decades.

If differential subsidence induces fissuring in the basin-fill deposits, such fissures would be expected to occur in the areas of greatest subsidence (in the KVCWF area) and while ground water levels are falling (during pumping or soon thereafter). Hence, any potential impacts would likely be noticed prior to cessation of mine reclamation.

- **Impact 3.2.3.3-8:** Differential subsidence could result in the development of fissures, creating a potential to degrade waters of the state. Fissures could provide a preferential flow path for uncontained process fluids or chemical or hydrocarbon releases. Capture of surface runoff by fissures may form erosional fissure gullies, which represent a safety risk to wildlife, livestock, wild horses, and people.

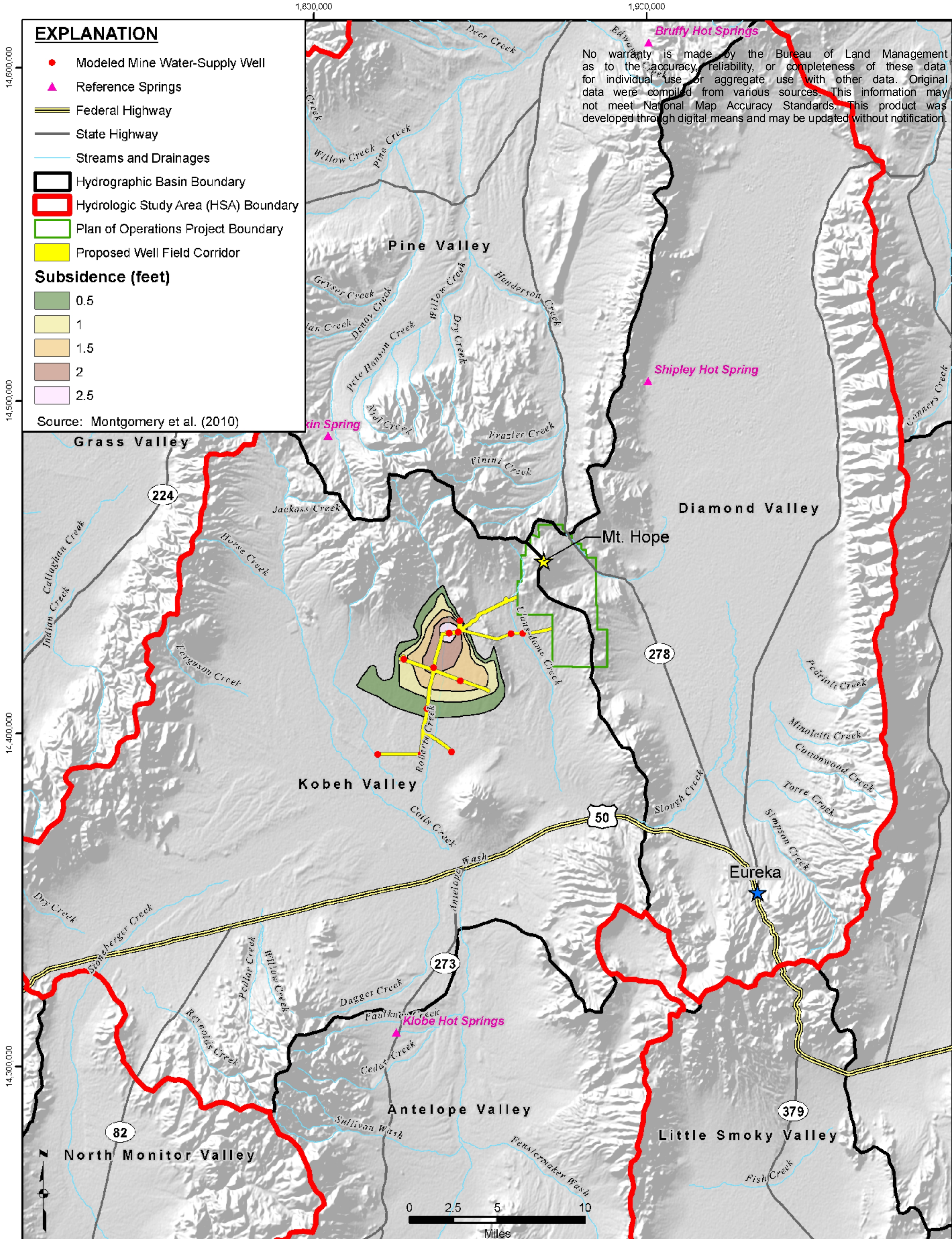
  Significance of the Impact: The impact would be significant if fissure gullies formed.

- **Mitigation Measure 3.2.3.3-8:** EML would be responsible for specifically monitoring for fissure gully development. If fissure gullies form, they would be filled in with clean, coarse-grained alluvium, with the intent of providing a rapid means of dissipation for any surface water entering the fissure and thereby reducing the propagation of the fissure through continued erosion. The fill material then would be seeded with a BLM-approved seed mix.

- **Effectiveness of Mitigation and Residual Effects:** Implementation of Mitigation Measure 3.2.3.3-8 would be effective at mitigating the fissures that develop because they would be filled immediately. Any residual effects of fissure development would be fully mitigated during the life of the Project.

3.2.3.4 No Action Alternative

Under the No Action Alternative, the proposed Project would not be developed, and the associated impacts would not occur. Under this alternative, consumptive uses of ground water in the HSA basins would continue according to existing authorizations. The modeling assumptions regarding assumed future ground water withdrawals under the No Action Alternative are described in Section 3.2.3.2.2 and summarized in Table 3.2-7.



Date: 7/07/10 Filename: Z:\MountHope_GIS_Project\RevisedFigures_June2010\Subsidence_KobehValley_MA_Rev.mxd UTM NAD83, Zone 11

BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD
CHECKED: -	APPROVED: RFD	DATE: 08/03/2012

FILE NAME: p1635_Fig3-2-X_Hydro_8i11i.mxd

BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Proposed Action Simulated Land Subsidence in Year 2055, Relative to 2009 Conditions

Figure 3.2.23

3.2.3.4.1 Surface Water Resources

Erosion, Sedimentation, and Flooding within Drainages

Under the No Action Alternative, there would be no mine-related alteration or diversion of existing natural drainages or washes that contain surface flow during high rainfall or snowmelt events. Existing exploration-related surface disturbance may cause an increase in erosion and sedimentation of the local surface drainages. Such impacts potentially could also occur as a result of other activities within the HSA that are not associated with the proposed Project.

- **Impact 3.2.3.4-1:** Grading, earth moving, diversion of drainages, and placement of fill could accelerate erosion and sedimentation, and alter surface-water flood runoff patterns in the future.

  Significance of the Impact: The impact is not considered significant.

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Effects of Ground Water Drawdown on Streams, Springs, and Surface Water Resources

Potential changes in water levels in the ground water system were evaluated using the methodology previously described in Section 3.2.3.2. The predicted change in ground water levels attributable to the No Action Alternative in Year 2055 is shown in Figure 3.2.23. This figure shows areas where the water levels are predicted to decrease over time in comparison to the existing baseline ground water elevation at the end of 2009, due solely to the simulated conditions under the No Action Alternative. By Year 2055, two distinct drawdown areas are predicted to develop: one near the Bobcat Ranch in the southwest part of Kobeh Valley, and one in the southern part of Diamond Valley. The ground water model results indicate that the ground water would be drawn down by up to 40 feet in the Bobcat Ranch area and by approximately up to 110 feet in the southern part of Diamond Valley, relative to existing (2009) conditions. The projected extent of future drawdown greater than ten feet encompasses one spring site and portions of five intermittent and ephemeral drainages in the Bobcat Ranch area, and numerous spring sites and stream drainages in the southern part of Diamond Valley.

- **Impact 3.2.3.4-2:** The future ground water drawdown (relative to existing conditions in 2009) is predicted to be more than ten feet at one spring site and portions of five intermittent and ephemeral drainages in the Bobcat Ranch area, and at numerous spring sites and stream drainages in the southern part of Diamond Valley by the end of Year 2055.

  Significance of the Impact: Impacts associated with the No Action Alternative are considered significant; however, these impacts are not under BLM jurisdiction and no mitigation is proposed.

3.2.3.4.2 Ground Water Resources

Lowering of the Water Table

Based on the ground water modeling, the assumed continued agricultural pumping in Kobeh and Diamond Valleys under the No Action Alternative would lower the water table in the basin-fill aquifers of those valleys by up to 40 feet and 110 feet in Year 2055, respectively, relative to existing (2009) conditions, as shown in Figure 3.2.2**4**. Continued pumping after that time may further increase the ground water drawdown in both areas, depending upon the magnitudes of the pumping rates.

Impacts to Ground Water Resources

There are numerous ground water users within the projected future drawdown area under the No Action Alternative (see Figure 3.2.3). Water rights associated with water-supply wells and surface water resources within the projected future drawdown area were included in the previously described inventory of water rights compiled for the EIS analysis (Section 3.2.2.7), but they are not individually addressed in this section for practical reasons; however, they are illustrated in Figure 3.2.2**4**. Notably, none of the non-EML-controlled water rights or wells predicted to be potentially impacted under the No Action Alternative are predicted to be impacted by the Proposed Action (or the Partial Backfill Alternative or the Off-Site Transfer of Ore Concentrate for Processing Alternative) leading to the conclusion that the impacts from the two alternatives are distinguishable.

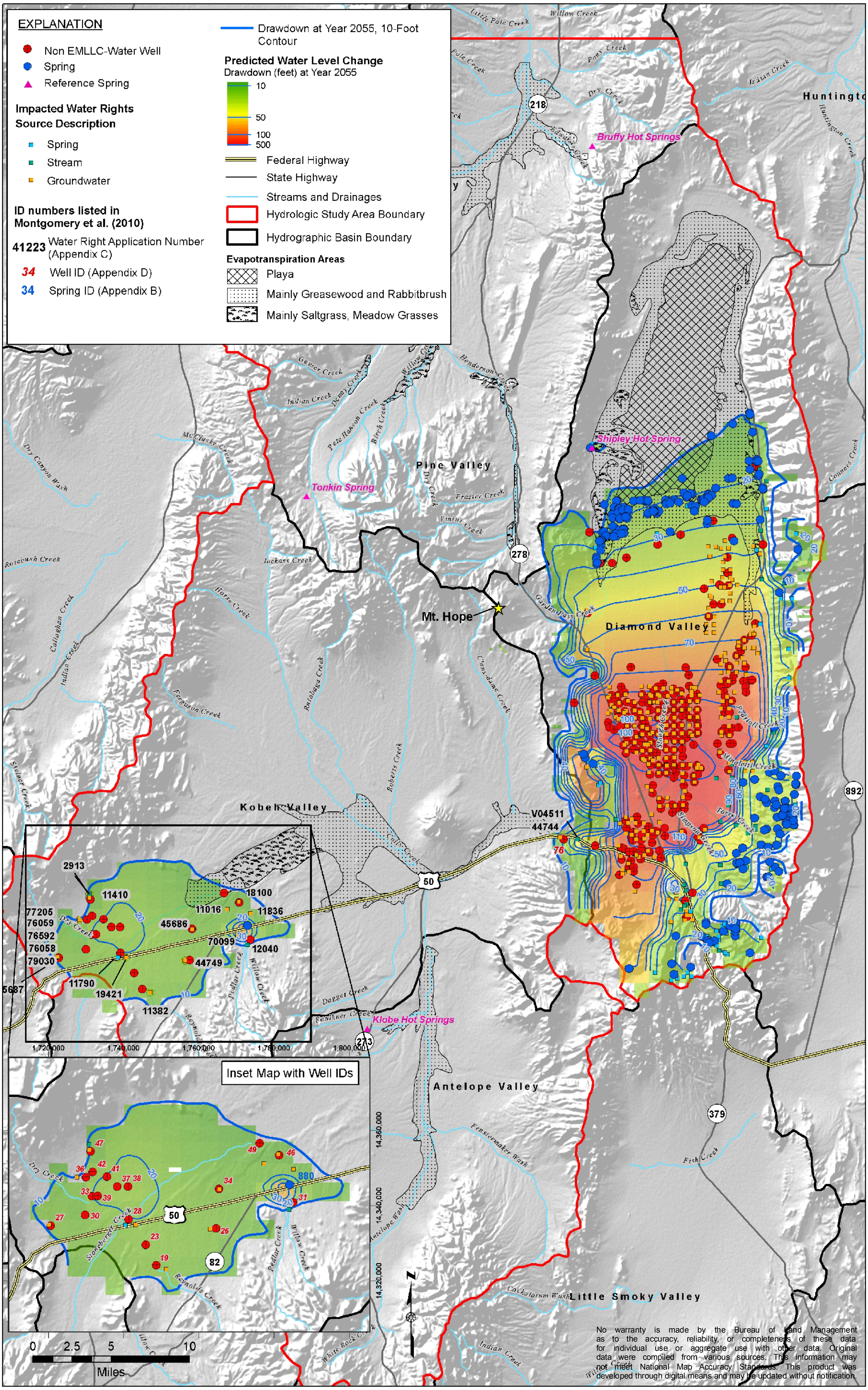
- **Impact 3.2.3.4-3:** The ground water drawdown is predicted to exceed ten feet at the locations of numerous active ground water rights controlled by third parties in the Bobcat Ranch area of Kobeh Valley and in the southern part of Diamond Valley by the end of Year 2055. None of these locations are predicted to be impacted by the Proposed Action, the Partial Backfill Alternative, or the Off-Site Transfer of Ore Concentrate for Processing Alternative.

  Significance of the Impact: Impacts associated with the No Action Alternative are considered significant; however, these impacts are not under BLM jurisdiction and no mitigation is proposed.

Impacts to Basin Water Budgets

The water balance for the ground water system within the HSA was estimated using the calibrated ground water flow model (Montgomery et al. 2010) and the consumptive use assumptions for the No Action Alternative, as described in Section 3.2.3.2. The estimated annual ground water inflow and outflow rates in Years 2055 and 2105 are summarized in Tables 3.2-13 and 3.2-14, respectively. The projected pattern of changes in the water balance for the No Action Alternative through the end of Year 2105 indicate that there would be a continued decrease in **ET** and further reduction in the available ground water stored in Diamond Valley.

- **Impact 3.2.3.4-4:** Ground water flow modeling indicates that there would be a continued decrease in **ET** of ground water in Diamond Valley resulting from expanded drawdown associated with continued agricultural pumping.



Source: Montgomery et al. (2010).

BATTLE MOUNTAIN DISTRICT OFFICE Mount Lewis Field Office 50 Bastian Road Battle Mountain, Nevada 89820					BUREAU OF LAND MANAGEMENT MOUNT HOPE PROJECT	DRAWING TITLE: **No Action Alternative Simulated Ground Water-Level Change in Year 2055, Relative to 2009 Conditions** **Figure 3.2.24**
DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD				
CHECKED: -	APPROVED: -	DATE: 08/03/2012				
FILE NAME: p1635_Fig3-2-X_Hydro_11i17i.mxd						

Significance of the Impact: Impacts associated with the No Action Alternative are considered significant; however, these impacts are not under BLM jurisdiction and no mitigation is proposed.

Table 3.2-13: Simulated Ground Water Budgets for Individual Basins and the Entire HSA in 2055 Under the No Action Alternative[1]

Budget Component	Antelope Valley	Diamond Valley	Kobeh Valley	Pine Valley (within the HSA)	Entire HSA
Ground Water Inflow[2] (afy)					
Precipitation Recharge	4,100	21,400	13,200	34,900	73,600
Subsurface Inflow[5]	0	8,300 (5,900 from Pine Valley and 2,400 from Kobeh Valley)	5,100 (1,900 from Monitor Valley, 2,700 from Antelope Valley, and 500 from Pine Valley)	0	1,900 (from Monitor Valley to Kobeh Valley)
Net Total Inflow	**4,100**	**29,700**	**18,300**	**34,900**	**75,500**
Ground Water Outflow[2] (afy)					
Evapotranspiration[3,5]	1,400	9,100	15,000	17,100	42,600
Ground Water Pumping[5]	negligible	55,800	3,800	negligible	59,600
Subsurface Outflow[5]	2,700 (to Kobeh Valley)	0	2,400 (to Diamond Valley)	17,700 (5,900 to Diamond Valley, 500 to Kobeh Valley, and 11,300 to northern Pine Valley)	11,300 (from southern to northern Pine Valley)
Net Total Outflow	**4,100**	**64,900**	**21,200**	**34,800**	**113,600**

[1] Estimation based on sources of data and methods described in Montgomery et al. (2010), including results from the calibrated numerical ground water model.
[2] Values rounded to the nearest 100 afy.
[3] Includes ET from phreatophyte areas and evaporation from playas and spring discharge.
[4] Source: Montgomery et al. (2010), Table 4.1-5.
[5] Source: Montgomery et al. (2010), Table 4.4-5.
[6] Source: Montgomery et al. (2010), Figure 4.4-2.

Table 3.2-14: Simulated Ground Water Budgets for Individual Basins and the Entire HSA in 2105 Under the No Action Alternative[1]

Budget Component	Antelope Valley	Diamond Valley	Kobeh Valley	Pine Valley (within the HSA)	Entire HSA
Ground Water Inflow[2] (afy)					
Precipitation Recharge[4]	4,100	21,400	13,200	34,900	73,600
Subsurface Inflow[5]	0	8,700 (6,100 from Pine Valley and 2,600 from Kobeh Valley)	5,400 (2,100 from Monitor Valley, 2,700 from Antelope Valley, and 600 from Pine Valley)	0	2,100 (from Monitor Valley to Kobeh Valley)

Budget Component	Antelope Valley	Diamond Valley	Kobeh Valley	Pine Valley (within the HSA)	Entire HSA
Net Total Inflow	**4,100**	**30,100**	**18,600**	**34,900**	**75,700**
Ground Water Outflow[2] (afy)					
Evapotranspiration[3,5]	1,400	6,300	14,300	17,000	39,000
Net Ground Water Pumping[6]	negligible	55,800	3,800	negligible	59,600
Subsurface Outflow[5]	2,700 (to Kobeh Valley)	0	2,600 (to Diamond Valley)	18,000 (6,100 to Diamond Valley, 600 to Kobeh Valley, and 11,300 to northern Pine Valley)	11,300 (from southern to northern Pine Valley)
Total Outflow	**4,100**	**62,100**	**20,700**	**35,000**	**110,000**
Net Total Outflow	**0**	**-32,000**	**-2,100**	**-100**	**-34,300**

[1] Estimation based on sources of data and methods described in Montgomery et al. (2010), including results from the calibrated numerical ground water model.
[2] Values rounded to the nearest 100 afy.
[3] Includes ET from phreatophyte areas and evaporation from playas and spring discharge.
[4] Source: Montgomery et al. (2010), Table 4.1-5.
[5] Source: Montgomery et al. (2010), Table 4.4-5.
[6] Source: Montgomery et al. (2010), Figure 4.4-2.

- **Impact 3.2.3.4-5:** Ground water flow modeling indicates that there would be a further decrease in the available ground water stored in Diamond Valley due to continued agricultural pumping under the No Action Alternative, and that the declining trend in available ground water would persist until Year 2105 or longer depending upon future pumping rates.

  Significance of the Impact: Impacts associated with the No Action Alternative are considered significant; however, these impacts are not under BLM jurisdiction and no mitigation is proposed.

<u>Consumptive Losses</u>

For ground water modeling purposes, it was assumed that future consumptive use of ground water in Kobeh and Diamond Valleys would be constant at rates that are similar in magnitude to those experienced in recent years and persisting for the foreseeable future. The estimated future average annual rates of usage were 2,355 gallons per minute (3,800 afy) in Kobeh Valley and 34,630 gallons per minute (55,850 afy) in Diamond Valley, as listed in Tables 3.2-12 and 3.2-13. In reality, future pumping rates would not be constant over time and they may vary significantly from the modeling assumptions.

- **Impact 3.2.3.4-6:** Consumptive use of water for authorized agricultural irrigation, stock watering, mining and milling, or municipal uses constitute beneficial uses of water resources. However, the historical and existing (2009) rates of consumptive usage in Diamond Valley already appear to have impacted some water resources and may be unsustainable in the long term. Some of the pumping-related consumption of ground water in Diamond Valley is offset by the reduction in ground water loss due to less **ET** as the water table declines.

Significance of the Impact: Impacts associated with the No Action Alternative are not considered significant.

Potential Impacts Due to Subsidence

The basis for this potential impact and the assessment methodology are the same as described for the Proposed Action in Section 3.2.3.3.2; therefore, they will not be repeated here. The numerical model shows that under the No Action Alternative, future subsidence (i.e., relative to existing conditions in 2009) of up to approximately 13.5 feet would occur in the southern part of Diamond Valley by the end of Year 2055 (Figure 3.2.25). The projected lateral extent of subsidence greater than one-half-foot extends approximately 13 miles to the north and south and five miles to the east and west from the center of maximum subsidence in southern Diamond Valley. There is also a small area of predicted subsidence of approximately one-half-foot magnitude along Slough Creek immediately west of Devils Gate in Kobeh Valley in Year 2055 under the No Action Alternative. There is no predicted land subsidence due to the effects of ground water withdrawals under the No Action Alternative anywhere else within the HSA.

Potential for Changes to Aquifer Productivity

The greatest potential for permanent deformation would occur in the finer grained sediments (clays and silty clays), which are not the primary water-bearing materials in the basin-fill aquifer of Diamond Valley. The result would be a loss in aquifer interbed storage and, presumably, some loss in aquifer productivity of water supply wells (given the magnitude of the projected maximum future subsidence).

- **Impact 3.2.3.4-7:** A change in aquifer characteristics is expected to result from compaction of the aquifer materials. Ground subsidence of greater than one-half-foot is projected to extend approximately 13 miles to the north and south and five miles to the east and west from the center of maximum subsidence (approximately 13.5 feet) in southern Diamond Valley. The subsidence would result primarily from a permanent reduction in porosity of the finer grained sediments (clays and silty clays), but some reduction in the porosity of the primary water-bearing materials in the basin-fill aquifer may also occur.

  Significance of the Impact: Impacts associated with the No Action Alternative are considered significant; however, these impacts are not under BLM jurisdiction and no mitigation is proposed.

Potential for Significant Land Surface Alteration

Consolidation of sediments that results in subsidence could also produce changes at the land surface. As noted above, ground subsidence of up to approximately 13.5 feet would occur in the southern part of Diamond Valley, and subsidence of up to one-half-foot is projected to extend approximately 13 miles to the north and south and five miles to the east and west from the center of maximum subsidence. If the future subsidence is not evenly distributed, the subsidence may induce fissuring or promote the formation of fissure gullies, which could alter surface drainage patterns, create a safety risk for animals and humans, or allow potential contaminants to rapidly enter the ground water system. The issues and risks associated with this potential impact are the same as described for the Proposed Action in Section 3.2.3.3.2; therefore, they will not be repeated here.

- **Impact 3.2.3.4-8:** Differential subsidence could result in the development of fissures, creating a potential to degrade waters of the state. Fissures could provide a preferential flow path for contaminants released at the ground surface to reach the ground water system. Capture of surface runoff by fissures may form erosional fissure gullies, which represent a safety risk to wildlife, livestock, wild horses, and people.

  Significance of the Impact: Impacts associated with the No Action Alternative are considered significant; however, these impacts are not under BLM jurisdiction and no mitigation is proposed.

3.2.3.5 Partial Backfill Alternative

The Partial Backfill Alternative (described in Section 2.2.2) would have the same potential water quantity impacts as the Proposed Action (Section 3.2.3.3) during the 33-year period of open pit mining, but the impacts would differ after mining and pit dewatering cease in 2044. After dewatering ceases, a pit lake would form as surrounding ground water levels recover under the Proposed Action; under the Partial Backfill Alternative, the pit would be partially backfilled to eliminate the potential for a pit lake to form, and the backfill material would saturate as ground water levels recover. The pre-mining ground water elevation in the vicinity of the proposed open pit varies from northwest to southeast across the site from approximately 7,200 to 6,750 feet amsl. Under the Partial Backfill Alternative, the open pit would be backfilled to elevations that would be at least 100 feet above the sloping, pre-mining ground water surface, thus preventing any substantial evaporative ground water losses from that area, as well as allowing precipitation within the open pit to flow freely out of the open pit at the southeastern edge.

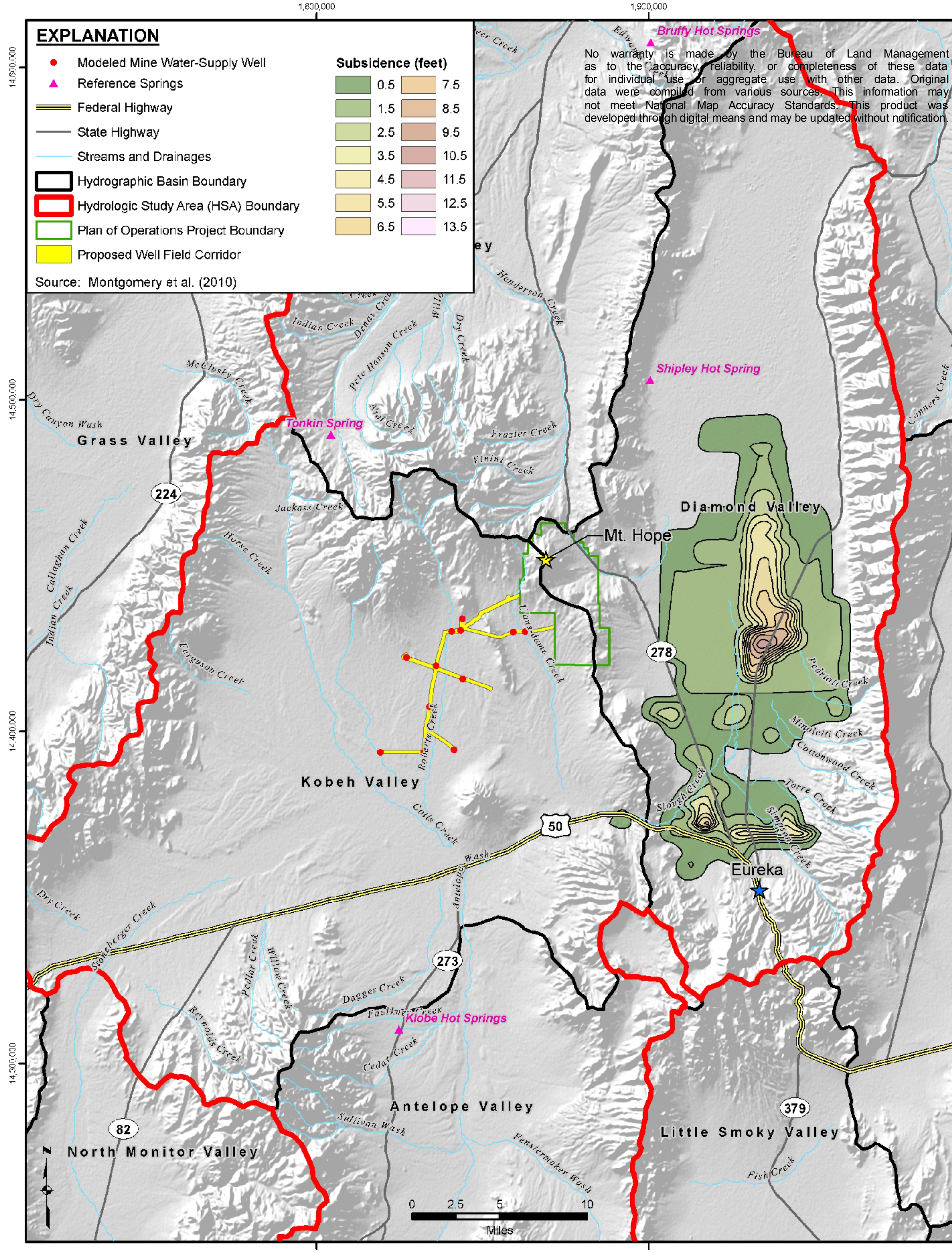
As ground water flows into the backfilled pit and the backfill becomes saturated there would be a corresponding ground water outflow from the backfilled pit soon after the end of mining. The onset of a well-defined flow-through condition would occur approximately 210 years after the end of dewatering and backfilling commences. Contours of the simulated ground water levels after 210 years of recovery are provided in Figure 3.2.2**6**.

3.2.3.5.1 Surface Water Resources

Erosion, Sedimentation, and Flooding within Drainages

Even with the implementation of the Project BMPs, the potential impacts to surface drainages involving erosion, sedimentation, or alteration of flood runoff patterns under the Partial Backfill Alternative would occur, but would be proportionally less than for the Proposed Action, due to the smaller WRDFs as described in Section 3.2.3.3.1. This is primarily due to the placement of a large portion of the waste rock in the open pit and thus only the reclaimed surface of the backfill would be subject to erosion.

- **Impact 3.2.3.5-1:** Grading, earth moving, diversion of drainages, and placement of fill could accelerate erosion and sedimentation and alter surface-water flood runoff patterns during mining and post-closure.



Date: 7/07/10 Filename: Z:\MountHope_GIS_Project\RevisedFigures_June2010\Subsidence_KobehValley_MA_Rev.mxd UTM NAD83, Zone 11

BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD
CHECKED: -	APPROVED: RFD	DATE: 08/03/2012

FILE NAME: p1635_Fig3-2-X_Hydro_8i11i.mxd

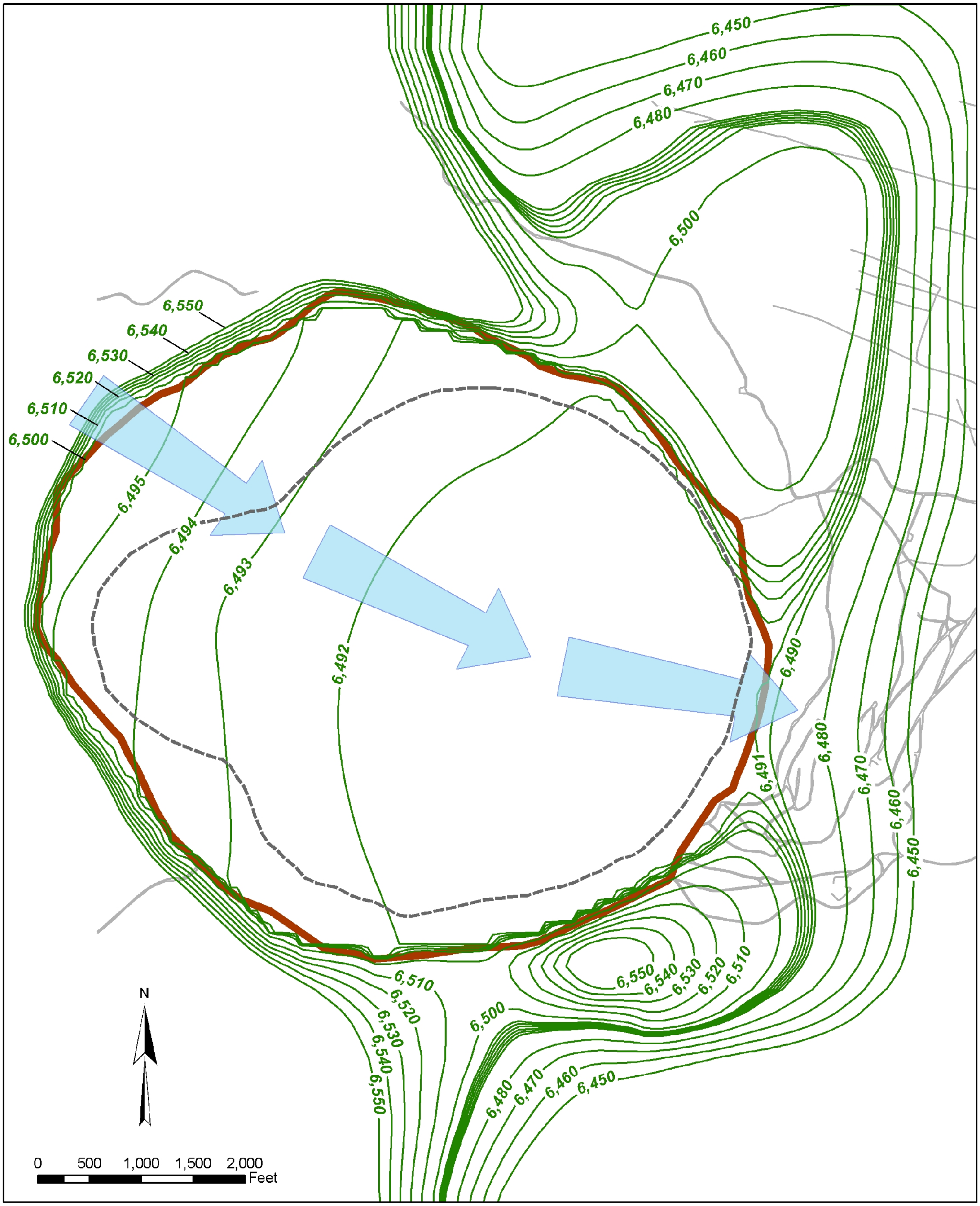
BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

No Action Alternative Simulated Land Subsidence in Year 2055, Relative to 2009 Conditions

Figure 3.2.25



EXPLANATION

Final Pit Extent

Direction of Groundwater Movement

Roads

Final Backfill Extent

6,500 Simulated Water Level Contours in feet above mean sea level

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

BATTLE MOUNTAIN DISTRICT OFFICE Mount Lewis Field Office 50 Bastian Road Battle Mountain, Nevada 89820			BUREAU OF LAND MANAGEMENT MOUNT HOPE PROJECT	DRAWING TITLE: Simulated Water Level Contours in the Backfill Area 210 Years After End of Open Pit Mining Figure 3.2.26
DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD		
CHECKED: -	APPROVED: RFD	DATE: 08/03/2012		
FILE NAME: p1635_Fig3-2-26_SimWL_Backfill_210yrs.mxd				

Significance of the Impact: The impact is not considered significant.

No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Effects of Ground Water Drawdown on Streams, Springs, and Surface Water Resources

Potential impacts to the flow of streams and springs in the HSA resulting from mine-related ground water drawdown under the Partial Backfill Alternative would be proportionally less than for the Proposed Action, as described in Section 3.2.3.3.1. Figure 3.2.2**7** shows the maximum extent of drawdown under the Partial Backfill Alternative. There is very little difference from the potential impacts under the Proposed Action. However, near the open pit the maximum extent of drawdown is less and two springs are not located within the predicted extent of the ten-foot drawdown under the Partial Backfill Alternative (Spring sites **583** and 592) (Table 3.2-8). In addition, the location of Spring SP-7 would be uncovered by the placement of the Non-PAG waste rock in the open pit.

- **Impact 3.2.3.5-2:** The ground water drawdown is predicted to be more than ten feet for two perennial stream segments (Roberts Creek and South Fork of Henderson Creek) and at 2**0** perennial or potentially perennial spring sites (Table 3.2-8) for varying periods of time up to at least 400 years after the end of mining and milling operations. **Other individual streams and springs outside of the model predictions could also be impacted.**

  Significance of the Impact: The impacts are potentially significant at the two stream segments and 2**0** springs mentioned above. Although significant impacts are not predicted to occur in the other individual streams or springs in the HSA, the uncertainty of predicting impacts to streams and springs indicates a need for operational monitoring and mitigation measures to be implemented. If **monitoring, which has been incorporated into the mitigation measure, indicates that** there are reduced flows in perennial stream segments or springs that the BLM determines can be attributed to the mining operation, then **specific** mitigation would be implemented**,** as described below. Potential adverse effects to surface water rights would be mitigated **under** NDWR **j**urisdiction.

- **Mitigation Measure 3.2.3.5-2a:** Specific mitigation for the two perennial stream segments and 2**0** perennial or potentially perennial spring sites are outlined in Table 3.2-9. **Figure 3.2.21 shows the anticipated location for the components of the facilities necessary to implement the mitigation measures outlined in Table 3.2-9. Implementation of any of the specific mitigation outlined in Table 3.2-9 for springs located on private land would be subject to the authorization of the private land owner. The site-specific evaluation of the effectiveness of this specific mitigation for each identified surface water resource within the mine-related ground water drawdown area is presented in Table 3.2-9. The site-specific measures include one or more methods identified in Mitigation Measure (3.2.3.5-2b). Similar methods (as identified in Table 3.2-9) would also be applied to streams and springs not identified in this analysis, if monitoring indicates that there are impacts that the BLM determines can be attributed to the mining operation.** Implementation of the mitigation outlined in **T**able **3.2-9** would result in up to **approximately 29.8** acres of additional surface disturbance associated with the pipeline construction and maintenance**, as well as the need for approximately 302 acre-feet of water that would at least initially come from EML's existing water rights if additional water rights have not yet been secured**. **This specific mitigation would be implemented, as determined by the BLM, based on the results of the monitoring outlined in this mitigation measure.** EML would implement the water monitoring provisions outlined in Section 2.1.15 and Appendix **C** to track the drawdown associated with the open pit dewatering and ground water production activities. In addition, EML would periodically update the ground water flow as determined by the BLM. EML would be responsible for monitoring and annual reporting of changes in ground water levels and surface water flows prior to and during operation, and for a period of up to 30 years in the post-mining and milling phase. **The reports would be in a format and with a content that is acceptable to the BLM. The monitoring outlined in Appendix C and required in this mitigation measure would be used to document the effectiveness of the implemented specific mitigation activities. In addition, the BLM has the ability to require the implementation of additional mitigation measures if the initial implementation is unsuccessful.**

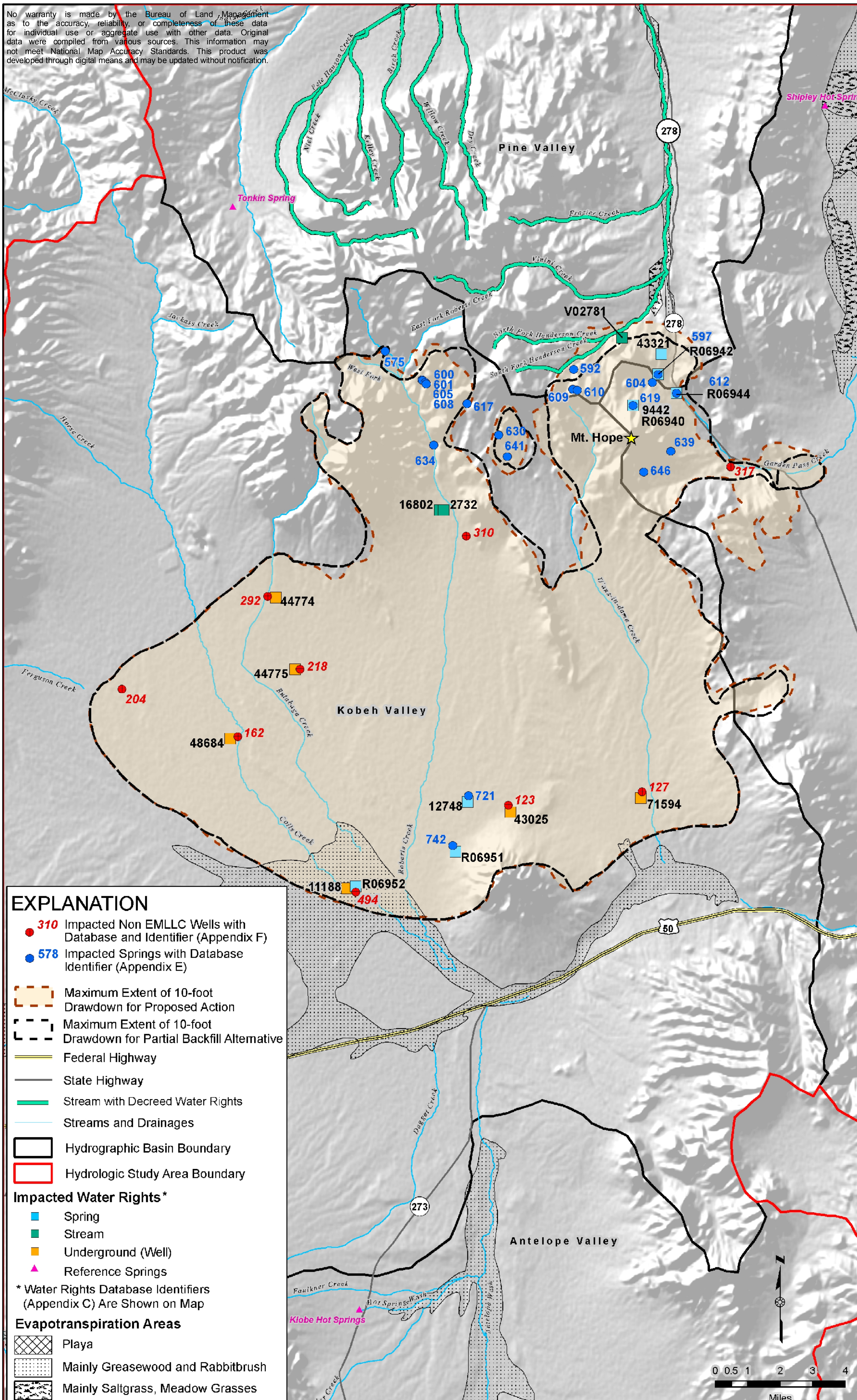
- **Mitigation Measure 3.2.3.5-2b**: If monitoring (Mitigation Measure 3.2.3.5-2a) indicates that flow reductions of perennial surface waters are occurring and that these reductions are likely the result of mine-induced drawdown, the following measures would be implemented:

  1. The BLM would evaluate the available information and determine whether mitigation is required.

  2. If mitigation would be required by the BLM for BLM-administered resources, then EML would be responsible for preparing a detailed, site-specific plan to enhance or replace the impacted perennial water resource(s). Potential adverse effects to surface water rights would be mitigated **under** NDWR jurisdiction**, as well as potential need for additional BLM permit acquisition activities and NEPA analysis**.

     The mitigation plan would be submitted to the BLM identifying the excess amount of drawdown or drawdown impacts to surface water resources. Mitigation would depend on the actual impacts, site-specific conditions, and historical use and could include a variety of measures (e.g., flow augmentation, on-site, or off-site improvements). Methods to enhance or replace the impacted perennial water resources include, but are not limited to, the following:

     - Modification**, including cessation,** of pumping distribution in the water supply well field;
     - Injection to confine the drawdown cone;
     - Installation of a water-supply pump in an existing well (e.g., monitoring well);
     - Installation of a new water production well;
     - Piping from a new or existing source;
     - Installation of a guzzler;



BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD
CHECKED: -	APPROVED: -	DATE: 08/03/2012

FILE NAME: p1635_Fig3-2-27_ComparPropActPitBackfillSpringsNonEMLLCWells.mxd

BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Comparison of Proposed Action and Partial Backfill Alternative with Respect to Springs, Non-EML Wells and Water Rights within the Composite Maximum Extent of the Ten-Foot Drawdown Contour

Figure 3.2.27

- Enhanced development of an existing seep or spring to promote additional flow;
- **Water hauling;**
- **Removal of piñon-juniper in impacted watersheds;** or
- Fencing or other protective measures for an existing seep to maintain flow.

3. An approved site-specific mitigation plan would be implemented followed by monitoring and reporting to measure the effectiveness of the implemented measures.

■ **Mitigation Measure 3.2.3.5-2c**: The numerical ground water flow modeling indicates that some impacts to springs may occur after the end of mining and milling operations, when some of the operational measures described above may not be available. For the post-Project delayed impacts of drawdown, the ground water flow model would be updated during the closure process consistent with regulations and policy using the accumulated field data for pumping rates, consumptive use, and observed drawdown within the HSA to re-evaluate projected drawdown that would occur after the end of mining and milling operations. If the BLM determines that the Project would impact perennial stream segments or spring sites in this post-operational phase, mitigation consisting of one or both of the following measures would be required:

1. Installation of a well and pump at affected stream or spring locations to restore the historic yield of the affected surface water resource.

2. Posting of an additional financial guarantee to provide for potentially affected water supplies in the future.

■ **Effectiveness of Mitigation and Residual Effects:** Mitigation would be designed to address the specific spring or surface water that is affected, which enhances the effectiveness of the mitigation. In addition, a variety of approaches to mitigation can be used within these measures to achieve the objective. These mitigation measures are expected to be effective because the mitigation measures are specifically intended to directly address the impact by restoring or enhancing surface flows, and because the measures would be reviewed and addressed by the BLM. The effectiveness of Mitigation Measure 3.2.3.5-2c, if implemented, is less certain since the mitigation would be many decades in the future. If initial implementation was not successful, the BLM may require implementation of additional measures. The feasibility and success of mitigation would depend on site-specific conditions and details of the mitigation plan. However, **this type of mitigation has been proven to be effective and** if measures used in Mitigation Measure 3.2.3.5-2b are implemented, then the measure should be effective at mitigating the impacts from reduced surface water flows. Over a long period of time (tens to **hundreds** of years) the effects to most surface water flows would diminish; however, for the springs nearest to the open pit, flows would be reduced or eliminated in perpetuity.

3.2.3.5.2 Ground Water Resources

Lowering of the Water Table

The dewatering associated with the proposed open pit mining under the Partial Backfill Alternative would lower the bedrock ground water elevations by approximately 2,250 feet in the vicinity of the open pit during mining operations. At the same time, and continuing for 12 years after the end of pit dewatering, pumping in the KVCWF for process water supply would lower the water table in the basin-fill and bedrock aquifers of central Kobeh Valley and the southern part of the Roberts Mountains. Based on numerical ground water flow modeling, the expected amount of drawdown near the center of the KVCWF is approximately 120 feet after 44 years of pumping under the Proposed Action (Montgomery et al. 2010). The ground water levels near the open pit and the KVCWF would begin to recover immediately after Project-related dewatering and pumping cease. The Local Model was used to evaluate the ground water recovery in the backfilled pit under the Partial Backfill Alternative (Figure 3.2.2**8**).

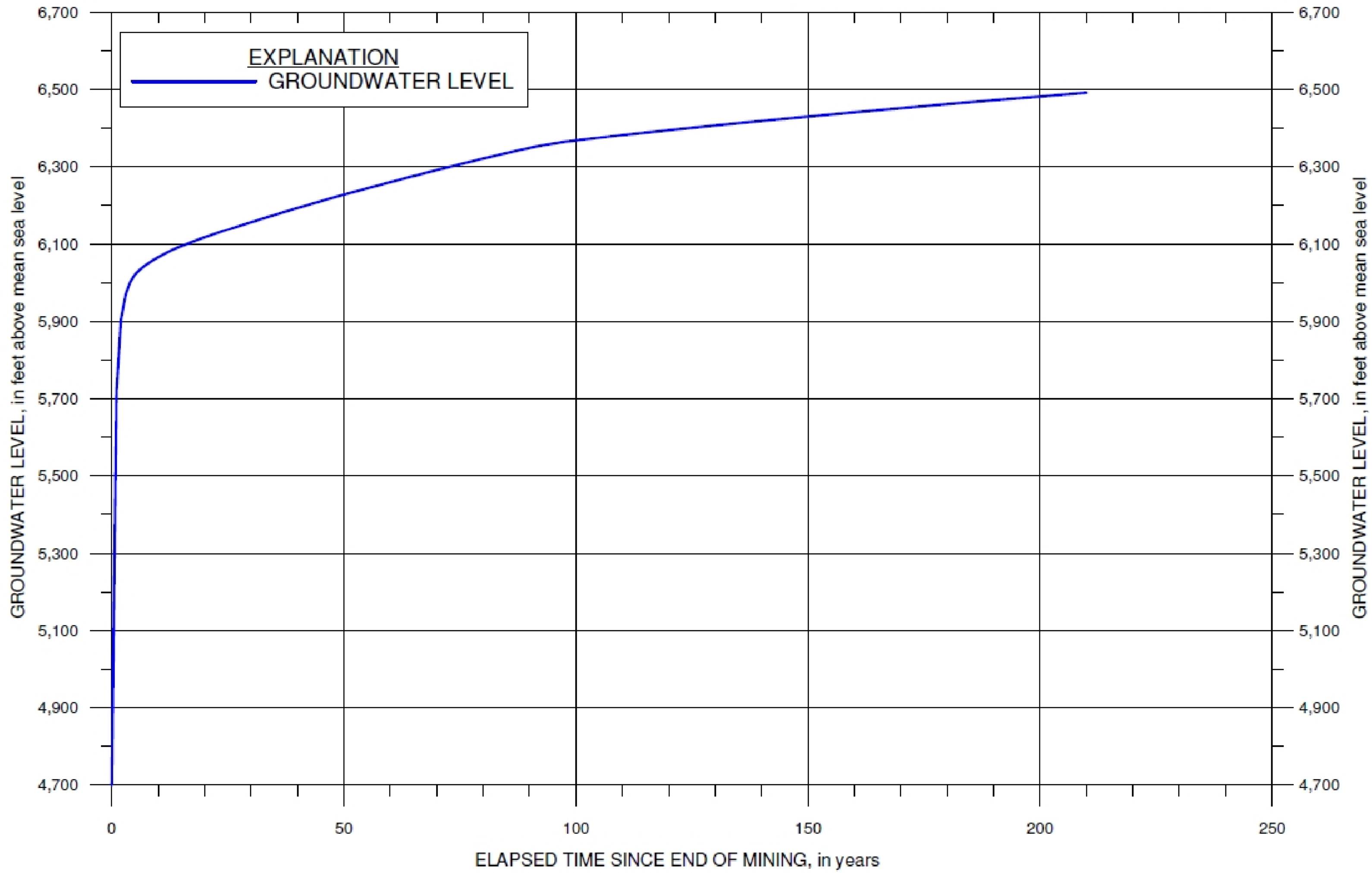
Impacts to Ground Water Resources

Potential impacts to the ground water and thus the associated ground water users in the HSA resulting from mine-related ground water drawdown under the Partial Backfill Alternative would be the same as for the Proposed Action, as described in Section 3.2.3.3.2 (Montgomery 2010). Therefore, they are not repeated here.

- **Impact 3.2.3.5-3:** The ground water drawdown is predicted to exceed ten feet at the locations of seven wells with associated **active** ground water **use with water** rights.

  Significance of the Impact: Impacts to the seven wells with associated **active** ground water **use with water** rights listed in Table 3.2-10 are potentially significant until such time as the ground water level recovers to less than ten feet of drawdown, which is predicted to be less than 100 years post-Project in all cases. The impacts would become less than significant after implementation of the mitigation measures described below. Potential adverse effects to ground water rights would be mitigated **under** NDWR jurisdiction. **Therefore no mitigation measures are proposed by the BLM for ground water rights. Section 3.26 includes suggested mitigation outside the BLM's jurisdiction for water rights.**

- **Mitigation Measure 3.2.3.5-3a:** For the seven wells with associated **active** ground water **use with water** rights EML would assess the distance of the screened interval and the pumping below the ground water table. If that difference is greater than maximum predicted drawdown, then EML would pay the water right holder for the increase in pumping costs based on historical usage. If the difference is greater than ten feet, then EML would pay for either the lowering of the pump to a depth greater than the maximum drawdown in the well, or the completion of a new well with the screened depth greater than the maximum predicted drawdown and pay the water right holder for the increase in pumping costs based on historic usage. In addition, EML would implement the water monitoring provisions outlined in Section 2.1.15 and in Appendix **C**. If, through implementation of the water monitoring, it is determined that there are impacts to wells with associated **active** ground water **use with water** rights attributable to the Project,



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD
CHECKED: -	APPROVED: RFD	DATE: 08/03/2012
FILE NAME: p1635_Fig3-2-28_GroundwaterLevel_graph.mxd		

BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Projected Ground Water Level in Center of Pit Backfill

Figure 3.2.28

whether predicted or not, then the following mitigation measures would be implemented. The combined surface water and ground water monitoring results would be used to trigger the implementation of Mitigation Measure 3.2.3.5-3b.

■ **Mitigation Measure 3.2.3.5-3b**: If monitoring (Mitigation Measure 3.2.3.5-3a) indicates that mine-induced drawdown impacts a well with associated **active ground** water **use with water** rights, the following measures would be implemented:

1. The BLM would evaluate the available information and **if the drawdown can be attributed to impacts from the Project, the mitigation described above would be required**.

2. If mitigation is required by the BLM, then EML would be responsible for preparing a detailed, site-specific plan to enhance or replace the impacted ground water. The mitigation plan would be submitted to the BLM identifying drawdown impacts to ground water resources. Mitigation would depend on the actual impacts and site-specific conditions and could include the following:

   - Lowering the pump in an existing well;
   - Deepening an existing well;
   - Drilling a new well for replacement of water supply;
   - Providing a replacement water supply of equivalent yield and general water quality;
   - Pay for any incremental increase in pumping costs;
   - Modifying the KVCWF pumping regime (well locations and/or rates) during operations to reduce draw down in the area of the impacted ground water resources;
   - Infiltrating or injecting water during operations at strategic locations to limit drawdown propagation in certain areas.

3. An approved site-specific mitigation plan would be implemented followed by monitoring and reporting to measure the effectiveness of the implemented measures.

■ **Mitigation Measure 3.2.3.5-3c**: For any significant impacts to wells with associated **active** ground water **use with water** rights that do not occur until after the end of mining and milling operations, the operational measures described above may not be available. For the post-Project delayed impacts of drawdown, the ground water flow model would be updated during the closure process consistent with regulations and policies using the accumulated field data for pumping rates, consumptive use, and observed drawdown within the HSA to re-evaluate projected drawdown that would occur after the end of mining and milling operations. Wells **with** associated active ground water **use with water** rights not owned or controlled by EML that are indicated to be significantly impacted would then be mitigated by **EML using** one or more of the following measures, as directed by the BLM or the appropriate regulatory agency:

1. Installation of a deeper well and pump at affected locations to restore the historical yield of the well (including incremental increase in pumping costs).

2. Posting of a funding mechanism to provide for potential future impacts to potentially affected water **sources**.

- **Effectiveness of Mitigation and Residual Effects:** Implementation of the Mitigation Measure 3.2.3.5-3b and the use of any of the options outlined above would be effective at mitigating the impacts to **wells with associated active** ground water **use with water** rights. Mitigation would be designed to address the specific ground water source that is affected, which enhances the effectiveness of the mitigation. These mitigation measures are expected to be effective because the mitigation measures are specifically intended to directly address the impact by providing financial compensation or ensuring that the water is made available, and because the measures **would** be reviewed and assessed by the BLM. If initial implementation was not successful, the BLM may require implementation of additional measures. The feasibility and success of mitigation would depend on site-specific conditions and details of the mitigation plan. Any residual effects to ground water rights would be fully mitigated and over a long period of time (tens to **hundreds** of years) the drawdown effects would fully diminish, except in the vicinity of the open pit where the effects would be in perpetuity.

Impacts to Basin Water Budgets

Potential impacts to water budgets of the basins in the HSA resulting from mine-related ground water withdrawals under the Partial Backfill Alternative would be very similar to those of the Proposed Action through the end of mine dewatering operations (Year 2044). At the end of open pit mining under the Partial Backfill Alternative, the pit would be partially backfilled to prevent the formation of a pit lake. As a result, the pit lake evaporation that would occur under the Proposed Action would not occur under the Partial Backfill Alternative. The recovery of ground water levels in the vicinity of the pit would be faster under the Partial Backfill Alternative than for the Proposed Action because less water from storage would be needed to fill the void spaces in the backfilled pit than would be needed to fill the open pit void space, and because there would be no ongoing evaporative losses from a lake surface during recovery under the Partial Backfill Alternative. The ground water elevations in the vicinity of the pit would ultimately recover to near the pre-mining levels under the Partial Backfill Alternative, whereas under the Proposed Action, the lake would act as a continual sink for ground water, resulting in a permanent drawdown of the water table locally around the open pit.

The estimated changes in annual ground water budgets under the Partial Backfill Alternative indicate that the mine-induced drawdown associated with pit dewatering and KVCWF pumping is predicted to result in a decrease in **ET** in all basins of the HSA. Most of the predicted decrease (95 percent at 50 years after the end of mine-related pumping) in **ET** within the HSA occurs in Kobeh Valley. The predicted water table drawdown in Kobeh Valley extends to the mapped phreatophyte areas northwest of Bean Flat and east of Lone Mountain (Figure 3.2.2**7**). The predominant phreatophyte vegetation in these areas is greasewood. The simulated extinction depth for greasewood is 40 feet below the ground surface, and the ground water model results indicate that the magnitude of drawdown along the perimeter of these phreatophyte vegetation areas would exceed the extinction depth for some period of time (Montgomery et al. 2010). This could potentially lead to a **change in composition and percent cover** of phreatophyte plants and an associated decrease in **ET** of ground water, as reflected in the estimated water budget changes listed in Tables 3.2-15 and 3.2-16.

In the final year of operations under the Partial Backfill Alternative (2055), the estimated available ground water in Diamond Valley is predicted to be reduced by 48 afy as a result of mine pit dewatering and KVCWF pumping, relative to the No Action Alternative at that same point in time (Table 3.2-15). An increase in subsurface inflow to Diamond Valley of 92 afy (31 afy from Pine Valley and 61 afy from Kobeh Valley) is also predicted to occur as a result of mine pit dewatering (since the open pit is mostly located within the Diamond Valley basin, but because that water would be pumped and consumptively used by the mine under the Partial Backfill Alternative, it would not contribute to the available ground water in Diamond Valley). Fifty years after the end of operations under the Partial Backfill Alternative (2105), the estimated available ground water in Diamond Valley is predicted to be reduced by 51 afy as a result of pit-lake capture and previous KVCWF pumping, relative to the No Action Alternative at that same point in time (Table 3.2-16). In 2105, a predicted increase in subsurface inflow to Diamond Valley of 65 afy (21 afy from Pine Valley and 44 afy from Kobeh Valley) results from flow-through in the backfilled pit. Thus, the modeling predicts a net increase of 14 afy in available ground water in Diamond Valley within 50 years post-Project under the Partial Backfill Alternative relative to the No Action Alternative.

Table 3.2-15: Estimated Change in Annual Ground Water Budgets in Final Year of Project (2055) Under the Partial Backfill Alternative, Relative to the No Action Alternative[1]

Budget Component	Antelope Valley	Diamond Valley	Kobeh Valley	Pine Valley (within the HSA)	Entire HSA
Change in Ground Water Inflow[2] (afy)					
Precipitation Recharge	0	0	0	0	0
Subsurface Inflow[4]	0	92 (31 from Pine Valley and 61 from Kobeh Valley)	179 (1 from Monitor Valley, 33 from Antelope Valley, and 145 from Pine Valley)	0	1 (from Monitor Valley to Kobeh Valley)
Net Change in Total Inflow	**0**	92	**179**	**0**	**1**
Change in Ground Water Outflow[2] (afy)					
Evapotranspiration[3]	-16	-48	-4,020	-11	-4,095
Net Ground Water Pumping	0	0	11,300	0	11,300
Subsurface Outflow	33 (to Kobeh Valley)	0	61 (to Diamond Valley)	179 (31 to Diamond Valley, 3 to North Pine Valley and 145 to Kobeh Valley)	-3
Net Change in Total Outflow	**17**	**-48**	**7,341**	**168**	**7,202**

[1] Estimation based on sources of data and methods described in Montgomery et al (2010) and Montgomery and Associates (2011), including results from the calibrated numerical ground water model.
[2] Positive values indicate increase and negative values indicate decrease in water budget component or in net change in total inflow and outflow.
[3] Includes ET from phreatophyte areas and evaporation from playas and spring discharge.

Table 3.2-16: Estimated Change in Annual Ground Water Budgets 50 Years Post-Project (2105) Under the Partial Backfill Alternative, Relative to the No Action Alternative[1]

Budget Component	Antelope Valley	Diamond Valley	Kobeh Valley	Pine Valley (within the HSA)	Entire HSA
Change in Ground Water Inflow[2] (afy)					
Precipitation Recharge	0	0	0	0	0
Subsurface Inflow[4]	0	65 (21 from Pine Valley and 44 from Kobeh Valley)	167 (14 from Monitor Valley, 38 from Antelope Valley, and 115 from Pine Valley)	0	14 (from Monitor Valley to Kobeh Valley)
Net Change in Total Inflow	**0**	**65**	**167**	**0**	**14**
Change in Ground Water Outflow[2] (afy)					
Evapotranspiration[3]	-30	-51	-2,305	-28	-2,414
Net Ground Water Pumping	0	0	0	0	0
Subsurface Outflow	38 (to Kobeh Valley)	0	44 (to Diamond Valley)	145 (21 to Diamond Valley, 9 to North Pine Valley, and 115 to Kobeh Valley)	-9
Net Change in Total Outflow	**8**	**-51**	**-2,261**	**117**	**-2,423**

[1] Estimation based on sources of data and methods described in Montgomery et al. (2010) and Montgomery & Associates (2011), including results from the calibrated numerical ground water model.
[2] Positive values indicate increase and negative values indicate decrease in water budget component or in net change in total inflow and outflow.
[3] Includes ET from phreatophyte areas and evaporation from playas and spring discharge.

The quantity of ground water leaving the HSA by subsurface flow and discharging into northern Pine Valley (the only location of subsurface outflow from the HSA) is predicted to decrease, relative to the No Action Alternative, as a result of mine dewatering and KVCWF pumping under the Partial Backfill Alternative from three afy at the end of the Project to nine afy at 50 years post-Project.

- **Impact 3.2.3.5-4**: Ground water flow modeling indicates that there could be up to an approximately 25 percent decrease in **ET** of ground water in Kobeh Valley due to **a change in** phreatophyte **composition and percent cover** resulting from temporary mine-induced drawdown.

  Significance of the Impact: The impact is not considered significant.

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

- **Impact 3.2.3.5-5:** Ground water flow modeling indicates that there could be a time-varying net change (decrease or increase) in the available ground water in Diamond Valley that is due solely to effects of the Partial Backfill Alternative by the end of mining and milling operations and for at least 50 years post-Project; however, the magnitude of the projected changes are less than 0.1 percent compared to the overall ground water budget for Diamond Valley.

Significance of the Impact: The impact is not considered significant.

No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Consumptive Losses

Pit dewatering and KVCWF pumping under the Partial Backfill Alternative would constitute a combined consumptive water use of 11,300 afy, on average, during the 44-year period of mining and milling operations. This consumptive use would cease at the end of that time period. After mining operations cease under the Partial Backfill Alternative, the backfilled material in the pit area would become saturated as ground water levels recover, but there would be no significant evaporative losses of ground water associated with that process.

- **Impact 3.2.3.5-6:** Consumptive use of water during mining and milling operations would support a beneficial use and would not be expected to adversely impact water resources. Long-term consumptive use of water by evaporation from the pit lake surface would not occur under the Partial Backfill Alternative, which is a positive impact compared to the Proposed Action and is a neutral impact compared to the No Action Alternative.

  Significance of the Impact: There is a positive impact compared to the Proposed Action and a neutral impact compared to the No Action Alternative. **Impacts during mining and milling operations are less than significant. After those operations cease, direct impacts of pit lake evaporation would not occur and would, therefore, not result in significant impacts.**

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Potential Impacts Due to Subsidence

Potential for Changes to Aquifer Productivity

Potential impacts to aquifer productivity resulting from dewatering-induced land subsidence under the Partial Backfill Alternative would be the same as for the Proposed Action, as described in Section 3.2.3.3.2. Therefore, they are not repeated here.

- **Impact 3.2.3.5-7:** A small change in aquifer characteristics is expected to result from compaction of the aquifer materials. Ground subsidence of greater than one-half-foot is projected to extend approximately four miles quasi-radially from the center of subsidence effects in the northern part of the KVCWF area, and a maximum subsidence of approximately 2.5 feet is projected in a small part of that central area. The subsidence would result primarily from a permanent reduction in porosity of the finer grained sediments (clays and silty clays), which are not the primary water-bearing materials in the basin-fill aquifer.

Significance of the Impact: The potential for the Kobeh Valley basin-fill aquifer to transmit or store water is not expected to be significantly impacted**.**

No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Potential for Significant Land Surface Alteration

Potential impacts to ground surface conditions (fissuring or alteration of drainage patterns) resulting from dewatering-induced land subsidence under the Partial Backfill Alternative would be the same as for the Proposed Action, as described in Section 3.2.3.3.2. Therefore, they are not repeated here.

- **Impact 3.2.3.5-8:** Differential subsidence could result in the development of fissures, creating a potential to degrade waters of the state. Fissures could provide a preferential flow path for uncontained process fluids or chemical or hydrocarbon releases. Capture of surface runoff by fissures may form erosional fissure gullies, which represent a safety risk to wildlife, livestock, wild horses, and people.

  Significance of the Impact: The impact would be significant if fissure gullies formed.

- **Mitigation Measure 3.2.3.5-8:** As part of the comprehensive water resources monitoring program (Mitigation Measure 3.2.3.5-2a), EML would be responsible for specifically monitoring for fissure gully development. If fissure gullies form, they would be filled in with clean, coarse-grained alluvium, with the intent of providing a rapid means of dissipation for any surface water entering the fissure and thereby reducing the propagation of the fissure through continued erosion. The fill material then would be seeded with a BLM-approved seed mix.

- **Effectiveness of Mitigation and Residual Effects:** Implementation of the Mitigation Measure 3.2.3.5-8 would be effective at mitigating the fissures that develop. Any residual effects of fissure development would be fully mitigated during the life of the Project.

3.2.3.6 Off-Site Transfer of Ore Concentrate for Processing Alternative

The Off-Site Transfer of Ore Concentrate for Processing Alternative (described in Section 2.2.3) would have the same potential water quantity impacts as the Proposed Action (Section 3.2.3.3) throughout the entire 44-year period of mining and milling operations and during the post-Project recovery period. There would be no reduction in the pit dewatering rates, the process-water supply requirements, or the pit lake evaporation rates under the Off-Site Transfer of Ore Concentrate for Processing Alternative, relative to the Proposed Action.

3.2.3.6.1 Surface Water Resources

Erosion, Sedimentation, and Flooding within Drainages

Even with the implementation of the Project BMPs, the potential impacts to surface drainages involving erosion, sedimentation, or alteration of flood runoff patterns under the Off-Site Transfer of Ore Concentrate for Processing Alternative would occur and would be the same as for the Proposed Action, as described in Section 3.2.3.3.1. Therefore, they are not repeated here.

- **Impact 3.2.3.6-1:** Grading, earth moving, diversion of drainages, and placement of fill could accelerate erosion and sedimentation and alter surface water flood runoff patterns during mining and post-closure.

  Significance of the Impact: The impact is not considered significant.

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Effects of Ground Water Drawdown on Streams, Springs, and Surface Water Resources

Potential impacts to the flow of streams and springs in the HSA resulting from mine-related ground water drawdown under the Off-Site Transfer of Ore Concentrate for Processing Alternative would be the same as for the Proposed Action, as described in Section 3.2.3.3.1. Therefore, they are not repeated here.

- **Impact 3.2.3.6-2:** The ground water drawdown is predicted to be more than ten feet for two perennial stream segments (Roberts Creek and South Fork of Henderson Creek) and at 22 perennial or potentially perennial spring sites (Table 3.2-8) for varying periods of time up to at least 400 years after the end of mining and milling operations. **Other individual streams and springs outside of the model predictions could also be impacted.**

  Significance of the Impact: The impacts are potentially significant at the two stream segments and 22 springs mentioned above. Although significant impacts are not predicted to occur in the other individual streams or springs in the HSA, the uncertainty of predicting impacts to streams and springs indicates a need for operational monitoring and mitigation measures to be implemented. If **monitoring, which has been incorporated into the mitigation measures, indicates that there are** reduced flows in perennial stream segments or springs that the BLM determines can be attributed to the mining operation, then **specific** mitigation would be implemented, as described below. In addition, potential adverse effects to surface water rights would be mitigated **under** NDWR jurisdiction.

- **Mitigation Measure 3.2.3.6-2a:** Specific mitigation for the two perennial stream segments and 22 perennial or potentially perennial spring sites are outlined in Table 3.2-9. **Figure 3.2.21 shows the anticipated location for the components of the facilities necessary to implement the mitigation measures outlined in Table 3.2-9. Implementation of any of the specific mitigation outlined in Table 3.2-9 for springs**

located on private land would be subject to the authorization of the private land owner. The site-specific evaluation of the effectiveness of this specific mitigation for each identified surface water resource within the mine-related ground water drawdown area is presented in Table 3.2-9. The site-specific measures include one or more methods identified in Mitigation Measure (3.2.3.6-2b). Similar methods (as identified in Table 3.2-9) would also be applied to streams and springs not identified in this analysis, if monitoring indicates that there are impacts that the BLM determines can be attributed to the mining operation. Implementation of the mitigation outlined in **T**able **3.2-9** would result in up to **37.2** acres of additional surface disturbance associated with the **road and** pipeline construction and maintenance**, as well as the need for approximately 302 acre-feet of water that would at least initially come from EML's existing water rights if additional water rights have not yet been secured**. **The specific mitigation would be implemented, as determined by the BLM, based on the results of the monitoring that is also outlined in this mitigation measure.** EML would implement the water monitoring provisions outlined in Section 2.1.15 and Appendix **C** to track the drawdown associated with the open pit dewatering and water production activities. In addition, EML would periodically update the ground water flow model as determined by the BLM. EML would be responsible for monitoring and annual reporting of changes in ground water levels and surface water flows prior to and during operation, and for a period of up to 30 years in the post mining and milling phase. **The reports would be in a format and with a content that is acceptable to the BLM. The monitoring outlined in Appendix C and required in this mitigation measure would be used to document the effectiveness of the implemented specific mitigation activities. In addition, the BLM has the ability to require the implementation of additional mitigation measures if the initial implementation is unsuccessful.**

- **Mitigation Measure 3.2.3.6-2b:** If monitoring (Mitigation Measure 3.2.3.6-2a) indicates that flow reductions of perennial surface waters are occurring and that these reductions are likely the result of mine-induced drawdown, the following measures would be implemented:

  1. The BLM would evaluate the available information and determine whether mitigation is required.

  2. If mitigation would be required by the BLM, then EML would be responsible for preparing a detailed, site-specific plan to enhance or replace the impacted perennial water resource(s). Potential adverse effects to water rights would be mitigated **under** NDWR jurisdiction**, as well as potential need for additional BLM permit acquisition activities and NEPA analysis**. The mitigation plan would be submitted to the BLM identifying the excess amount of drawdown or drawdown impacts to surface water resources. Mitigation would depend on the actual impacts, site-specific conditions, and historical use and could include a variety of measures (e.g., flow augmentation, on-site or off-site improvements). Methods to enhance or replace the impacted perennial water resources include, but are not limited to the following:

- Modification**, including cessation,** of pumping distribution in the water supply well field;
- Injection to confine the drawdown cone;
- Installation of a water-supply pump in an existing well (e.g., monitoring well);
- Installation of a new water production well;
- Piping from a new or existing source;
- Installation of a guzzler;
- Enhanced development of an existing seep or spring to promote additional flow;
- **Water hauling;**
- **Removal of piñon-juniper in impacted watersheds;** or
- Fencing or other protective measures for an existing seep to maintain flow.

3. An approved site-specific mitigation plan would be implemented followed by monitoring and reporting to measure the effectiveness of the implemented measures.

■ **Mitigation Measure 3.2.3.6-2c:** The numerical ground water flow modeling indicates that some impacts to springs may occur after the end of mining and milling operations, when some of the operational measures described above may not be available. For the post-Project delayed impacts of drawdown, the ground water flow model would be updated during the closure process consistent with regulations and policies using the accumulated field data for pumping rates, consumptive use, and observed drawdown within the HSA to re-evaluate projected drawdown that would occur after the end of mining and milling operations. If the BLM determines that the Project would impact perennial stream segments or spring sites in this post-operational phase, mitigation consisting of one or both of the following measures would be required:

1. Installation of a well and pump at affected stream or spring locations to restore the historic yield of the affected surface water resource.

2. Posting of an additional financial guarantee to provide for potentially affected water supplies in the future.

■ **Effectiveness of Mitigation and Residual Effects:** Mitigation would be designed to address the specific spring or surface water that is affected, which enhances the effectiveness of the mitigation. In addition, a variety of approaches to mitigation can be used within these measures to achieve the objective. These mitigation measures are expected to be effective because the mitigation measures are specifically intended to directly address the impact by restoring or enhancing surface flows, and because the measures would be reviewed and addressed by the BLM. The effectiveness of Mitigation Measure 3.2.3.6-2c, if implemented, is less certain since it would be many decades in the future. If initial implementation was not successful, the BLM may require implementation of additional measures. The feasibility and success of mitigation would depend on site-specific conditions and details of the mitigation plan. However, **this type of mitigation has been proven to be effective and** if measures used in Mitigation

Measure 3.2.3.6-2b are implemented, then the measure should be effective at mitigating the impacts from reduced surface water flows. Over a long period of time (tens to **hundreds** of years) the effects to most surface water flows would diminish; however, for the springs nearest to the open pit, flows would be reduced or eliminated in perpetuity.

3.2.3.6.2 Ground Water Resources

Lowering of the Water Table

Impacts to Ground Water Resources

Potential impacts to the water resources and thus the associated ground water users in the HSA resulting from mine-related ground water drawdown under the Off-Site Transfer of Ore Concentrate for Processing Alternative would be the same as for the Proposed Action, as described in Section 3.2.3.3.2. Therefore, they are not repeated here.

- **Impact 3.2.3.6-3:** The ground water drawdown is predicted to exceed ten feet at the locations of seven wells with associated **with active** ground water **use with water** rights.

  Significance of the Impact: Impacts to the seven wells with associated **active** ground water **use with water** rights listed in Table 3.2-10 are potentially significant until such time as the ground water level recovers to less than ten feet of drawdown, which is predicted to be less than 100 years post-Project in all cases. The impacts would become less than significant after implementation of the mitigation measures described below. Potential adverse effects to ground water rights would be mitigated **under** NDWR jurisdiction. **Therefore, no mitigation measures are proposed by the BLM for ground water rights. Section 3.26 includes suggested mitigation outside the BLM's jurisdiction for water rights.**

- **Mitigation Measure 3.2.3.6-3a:** For the seven wells with associated **active** ground water **use with water** rights EML would assess the distance of the screened interval and the pumping below the ground water table. If that difference is greater than maximum predicted drawdown, then EML would pay the water right holder for the increase in pumping costs based on historical usage. If the difference is greater than ten feet, then EML would pay for either the lowering of the pump to a depth greater than the maximum drawdown in the well, or the completion of a new well with the a screened depth greater than the maximum predicted drawdown and pay the water right holder for the increase in pumping costs based on historic usage. In addition, EML would implement the water monitoring provisions outlined in Section 2.1.15 and Appendix **C**. If, through implementation, of the water monitoring it is determined that there are impacts to wells with associated **active** ground water **use with water** rights attributable to the Project, whether predicted or not, then the following mitigation measures would be implemented. The combined surface water and ground water monitoring results would be used to trigger the implementation of Mitigation Measure 3.2.3.6-3b.

- **Mitigation Measure 3.2.3.6-3b:** If monitoring (Mitigation Measure 3.2.3.6-3a) indicate**s** that mine-induced drawdown impacts a well with associated **active ground water use with** water right**s**, the following measures would be implemented:

1. The BLM would evaluate the available information and **if the drawdown can be attributed to impacts from the Project, the mitigation described above would be required**.

2. If mitigation is required by the BLM, then EML would be responsible for preparing a detailed, site-specific plan to enhance or replace the impacted ground water. The mitigation plan would be submitted to the BLM identifying drawdown impacts to ground water resources. Mitigation would depend on the actual impacts and site-specific conditions and could include:

   - Lowering the pump in an existing well;
   - Deepening an existing well;
   - Drilling a new well for replacement of water supply;
   - Providing a replacement water supply of equivalent yield and general water quality;
   - Pay for any incremental increase in pumping costs;
   - Modifying the KVCWF pumping regime (well locations or rates) during operations to reduce draw down in the area of the impacted ground water resources;
   - Infiltrating or injecting water during operations at strategic locations to limit drawdown propagation in certain areas.

3. An approved site-specific mitigation plan would be implemented followed by monitoring and reporting to measure the effectiveness of the implemented measures.

■ **Mitigation Measure 3.2.3.6-3c:** For any significant impacts to wells with associated **active** ground water **use with water** rights that do not occur until after the end of mining and milling operations, the operational measures described above may not be available. For the post-Project delayed impacts of drawdown, the ground water flow model would be updated during the final year of the Project using the accumulated field data for pumping rates, consumptive use, and observed drawdown within the HSA to re-evaluate projected drawdown that would occur after the end of mining and milling operations. Wells **with** associated active ground water **use with water** rights that are not owned or controlled by EML that are indicated to be significantly impacted would then be mitigated by **EML using** one or more of the following measures, as directed by the NDWR, the BLM, or the appropriate regulatory agency:

1. Installation of a deeper well and pump at affected locations to restore the historical yield of the well (including incremental increase in pumping costs).

2. Posting of a funding mechanism to provide for potential future impacts to potentially affected water **sources**.

■ **Effectiveness of Mitigation and Residual Effects:** Implementation of the Mitigation Measure 3.2.3.6-3b and the use of any of the options outlined above would be effective at mitigating the impacts to **wells with associated active** ground water **use with water** rights. Mitigation would be designed to address the specific ground water source that is affected, which enhances the effectiveness of the mitigation. These mitigation measures are expected to be effective because the mitigation measures are specifically intended to directly address the impact by providing financial compensation or ensuring that the water is made available, and because the measures **would** be reviewed and assessed by the BLM. If initial implementation were unsuccessful, the BLM may require implementation of additional measures. The feasibility and success of mitigation would depend on site-specific conditions and details of the mitigation plan. Any residual effects to ground water **uses** would be fully mitigated and over a long period of time (tens to **hundreds** of years) the drawdown effects would fully diminish, except in the vicinity of the open pit where the effects would be in perpetuity.

<u>Impacts to Basin Water Budgets</u>

Potential impacts to the water budgets of the basins in the HSA resulting from mine-related ground water drawdown under the Off-Site Transfer of Ore Concentrate for Processing Alternative would be the same as for the Proposed Action, as described in Section 3.2.3.3.2. Therefore, they are not repeated here.

- **Impact 3.2.3.6-4:** Ground water flow modeling indicates that there could be up to an approximately 25 percent decrease in **ET** of ground water in Kobeh Valley due to **a change in** phreatophyte **composition and percent cover resulting from** temporary mine-induced drawdown, which would partially offset the mine-related consumptive use of water from the Kobeh Valley basin during mining and milling operations.

  Significance of the Impact: The impact is not considered significant.

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

- **Impact 3.2.3.6-5:** Ground water flow modeling indicates that there could be a time-varying net change (decrease or increase) in the available ground water in Diamond Valley that is due solely to effects of the Off-Site Transfer of Ore Concentrate for Processing Alternative by the end of mining and milling operations and for at least 50 years post-Project; however, the magnitude of the predicted changes are less than 0.1 percent compared to the overall ground water budget for Diamond Valley.

  Significance of the Impact: The impact is not considered significant.

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

<u>Consumptive Losses</u>

Potential impacts to water resources in the HSA resulting from long-term consumptive use of ground water under the Off-Site Transfer of Ore Concentrate for Processing Alternative would be the same as for the Proposed Action, as described in Section 3.2.3.3.2. Therefore, they are not repeated here.

- **Impact 3.2.3.6-6:** Consumptive use of water during mining and milling operations would support a beneficial use and would not be expected to adversely impact water resources, and EML would have adequate water rights to cover the consumptive use. Long-term consumptive use of ground water by evaporation from the pit lake surface is predicted to be approximately 100 gpm (161 afy) and would continue in perpetuity. This consumptive loss would only occur under the Off-Site Transfer of Ore Concentrate for Processing Alternative (and the Proposed Action and the Slower, Longer Project Alternative), and so represents a negative impact compared to the No Action Alternative. The 161 afy is less than 0.1 percent of the combined water budget for the Kobeh and Diamond Valleys.

  Significance of the Impact: Impacts during mining and milling operations are less than significant. After those operations cease, direct impacts of pit lake evaporation do not result in significant impacts.

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Potential Impacts Due to Subsidence

Potential for Changes to Aquifer Productivity

Potential impacts to aquifer productivity resulting from dewatering-induced land subsidence under the Off-Site Transfer of Ore Concentrate for Processing Alternative would be the same as for the Proposed Action, as described in Section 3.2.3.3.2. Therefore, they are not repeated here.

- **Impact 3.2.3.6-7:** A small change in aquifer characteristics is expected to result from compaction of the aquifer materials. Ground subsidence of greater than one-half-foot is projected to extend approximately four miles quasi-radially from the center of subsidence effects in the northern part of the KVCWF area, and a maximum subsidence of approximately 2.5 feet is projected in a small part of that central area. The subsidence would result primarily from a permanent reduction in porosity of the finer grained sediments (clays and silty clays), which are not the primary water-bearing materials in the basin-fill aquifer.

  Significance of the Impact: The potential for the Kobeh Valley basin-fill aquifer to transmit or store water is not expected to be significantly impacted**.**

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Potential for Significant Land Surface Alteration

Potential impacts to ground surface conditions (fissuring or alteration of drainage patterns) resulting from dewatering-induced land subsidence under the Off-Site Transfer of Ore Concentrate for Processing Alternative would be the same as for the Proposed Action, as described in Section 3.2.3.3.2. Therefore, they are not repeated here.

- **Impact 3.2.3.6-8:** Differential subsidence could result in the development of fissures, creating a potential to degrade waters of the state. Fissures could provide a preferential flow path for uncontained process fluids or chemical or hydrocarbon releases. Capture of surface runoff by fissures may form erosional fissure gullies, which represent a safety risk to wildlife, livestock, wild horses, and people.

  Significance of the Impact: The impact would be significant if fissure gullies formed.

- **Mitigation Measure 3.2.3.6-8:** EML would be responsible for specifically monitoring for fissure gully development. If fissure gullies form, they would be filled in with clean, coarse-grained alluvium, with the intent of providing a rapid means of dissipation for any surface water entering the fissure, thereby reducing the propagation of the fissure through continued erosion. The fill material then would be seeded with a BLM-approved seed mix.

- **Effectiveness of Mitigation and Residual Effects:** Implementation of the Mitigation Measure 3.2.3.6-8 would be effective at mitigating the fissures that develop. Any residual effects of fissure development would be fully mitigated during the life of the Project.

3.2.3.7 <u>Slower, Longer Project Alternative</u>

The Slower, Longer Project Alternative (described in Section 2.2.3) would have similar potential water quantity impacts as the Proposed Action (Section 3.2.3.3); however, these impacts would occur over different time frames due to the decreased ground water production on an annual basis, but over a longer time period. There would be no reduction in the pit dewatering rates compared to the Proposed Action due to dewatering through in pit drain sump. The process-water supply requirements would be the same over the life of the alternative, but less than the Proposed Action on a daily basis. The pit lake evaporation rates under the Slower, Longer Project Alternative, relative to the Proposed Action would be the same.

3.2.3.7.1 Surface Water Resources

Erosion, Sedimentation, and Flooding within Drainages

Even with the implementation of the Project BMPs, the potential impacts to surface drainages involving erosion, sedimentation, or alteration of flood runoff patterns under the Slower, Longer Project Alternative would occur and would be similar to those for the Proposed Action, although shifted in time, as described in Section 3.2.3.3.1. Therefore, they are not repeated here.

- **Impact 3.2.3.7-1:** Grading, earth moving, diversion of drainages, and placement of fill could accelerate erosion and sedimentation and alter surface-water flood runoff patterns during mining and post-closure.

  Significance of the Impact: The impact is not considered significant.

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Effects of Ground Water Drawdown on Streams, Springs, and Surface Water Resources

Potential impacts to the flow of streams and springs in the HSA resulting from mine-related ground water drawdown under the Slower, Longer Project Alternative would be similar in extent to those of the Proposed Action, as described in Section 3.2.3.3.1, but shifted in time due to the timing of activities under this alternative.

Figure 3.2.2**9** shows graphically the results of the numerical ground water flow model expressed as water table drawdown contours at the end of the mining and milling operations under the Project. This figure illustrates, for comparison, areas of predicted ground water drawdown relative to the existing baseline ground water elevations at the end of 2009, for both the Slower, Longer Project Alternative, as well as the Proposed Action. By the end of the mining and milling operations (in 2099), two distinct drawdown areas are predicted to develop: one area centered on the open pit and the other area surrounding the KVCWF wells. These ground water modeling results indicate that the ground water would be drawn down by more than ten feet at 24 spring locations (six more locations than under the Proposed Action) and at one perennial stream segment (Roberts Creek) at the end of the mining and milling operations. By the end of the predictive simulations **for** the **maximum extent of drawdown under the** Slower, Longer Project Alternative results indicate that the ground water would be drawn down by more than ten feet at **29** spring locations (eight more locations than under the Proposed Action). Table 3.2-8 indentifies the springs affected under the Proposed Action and Table 3.2-17 identifies those additional springs that may be affected under the Slower, Longer Project Alternative. The ground water level is not expected to be drawn down by more than ten feet at any other spring or perennial stream segment at the end of mining/milling operations. Nine of the potentially affected springs (Tables 3.2-8 and 3.2-17) and the perennial stream segment appear to be associated with water rights. In addition, springs that have not been identified as having PWRs, but with sufficient flows to support a PWR could be affected. **Impacts to surface water resources could occur in areas with less than ten feet of predicted drawdown.**

Table 3.2-17: Springs that May be Affected by Slower, Longer Project Alternative Which are in Addition to Those Under the Proposed Action

Spring Number	Spring Name	Basin	Flow (gpm)	Use
545	Unnamed Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses
558	Unnamed Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses
561	Unnamed Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses
568	Unnamed Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses
575	Unnamed Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses
584	Unnamed Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses
635	Unnamed Spring	Kobeh Valley	--	Livestock, Wildlife, and Wild Horses

After dewatering ceases (Year 64), the ground water would begin to recover in the open pit area. Similarly, ground water in the basin-fill and bedrock aquifers of Kobeh Valley would begin to recover when pumping in the KVCWF ceases (Year 88). The limits of ground water drawdown surrounding the open pit and KVCWF would continue to expand after open pit dewatering and production well pumping cease, as the open pit and dewatered portions of the aquifers fill with ground water that is derived from storage as well as natural recharge. Due to aquifer geometry and heterogeneity, the rate and ultimate extent of continued lateral expansion of drawdown would not be the same in all directions. Figure 3.2.**30** shows the simulated ten-foot water table drawdown contours at 12 time intervals, between ten and 400 years post-Project recovery, and illustrates the composite maximum-extent-of-drawdown used in this analysis. The boundary of the maximum-extent-of-drawdown encompasses all of the areas that are predicted to experience more than ten feet of drawdown at any time in the future due to the Slower, Longer Project Alternative. In the vicinity of Mount Hope, the maximum extent of the ten-foot drawdown contour is approximately one mile beyond its location at the end of the mining and milling operations, whereas for the area surrounding the KVCWF, the difference generally is much less (on the order of 0.1 mile) beyond the ten-foot drawdown contour at the end of active pumping. **Impacts to surface water resources could occur in areas with less than ten feet of predicted drawdown.**

The maximum extent of the ten-foot drawdown contour encompasses 29 springs, two perennial stream segments (Roberts Creek and South Fork of Henderson Creek), and portions of four intermittent and ephemeral stream drainages (Coils Creek, Rutabaga Creek, U'ans-in-dame Creek, and Garden Pass Creek), as shown in Figure 3.2.3**1**. As discussed in Section 3.2.2.3.1, the stream reaches and springs located in this area can be characterized as either intermittent, ephemeral, or perennial. Intermittent and ephemeral stream reaches and spring sites flow only during or after wet periods in response to rainfall or snowmelt runoff events. By definition, these surface waters are not controlled by discharge from the regional ground water system. During the low flow period of the year (late summer through fall), intermittent and ephemeral stream reaches and springs typically would be dry. In contrast, perennial stream segments and springs generally flow throughout the year. Flows observed during the wet periods, which typically extend from spring through early summer, include a combination of surface runoff and ground water discharge, whereas flows observed during the low-flow period are sustained entirely by discharge from the ground water system. If the flow in these stream segments and springs relies on the aquifer that is being dewatered, a reduction of ground water levels from mine-induced drawdown could reduce the ground water discharge to perennial stream segments or springs.

Of the 29 potentially impacted springs, nine appear to be associated with water rights (Table 3.2-6) and at least eight are considered perennial (Table 3.2-8), which is the same as under the Proposed Action. The identified potentially-impacted perennial springs are all located at high elevations in the Roberts Mountains and on the flanks of Mount Hope, and within approximately four miles of the proposed open pit. The source of these springs is believed to be the fractured bedrock aquifer, which receives recharge from the higher elevations as infiltration of snowmelt and rainfall.

Surface water flow in Roberts Creek, located approximately 6.5 miles west of the proposed open pit, is fed by springs that flow into Roberts Creek or its tributaries. The upper spring-fed segments of Roberts Creek generally flow throughout the year, **and as with other springs in the upper elevations of Roberts Mountain** the springs within the drawdown area that feed those segments are believed to originate in areas of localized, perched ground water that are not hydraulically interconnected with the regional ground water system. **It is also possible that geologic block faulting has compartmentalized the ground water flow at some of these spring sites so that they would be isolated from mine-induced drawdown, but there is no available evidence to define such conditions if they exist. For the purposes of this analysis,**

EXPLANATION

- Model Wellfield Pumping Wells
- Monitor Wells
- Reference Springs
- Location of Simulated Drawdown or Discharge Hydrograph
- Federal Highway
- State Highway
- Streams and Drainages
- Stream with Decreed Water Rights
- Drawdown, 10-foot contours Outer limit in **bold**
- Well Field Corridor
- Hydrographic Basin Boundary
- Hydrologic Study Area Boundary

Evapotranspiration Areas

- Mainly Greasewood and Rabbitbrush
- Playa
- Mainly Saltgrass, Meadow Grasses

Bean Flat — Name of Phreatophyte Area

Projected Drawdown, in feet

- 10 (min)
- 25
- 55
- 75
- > 100

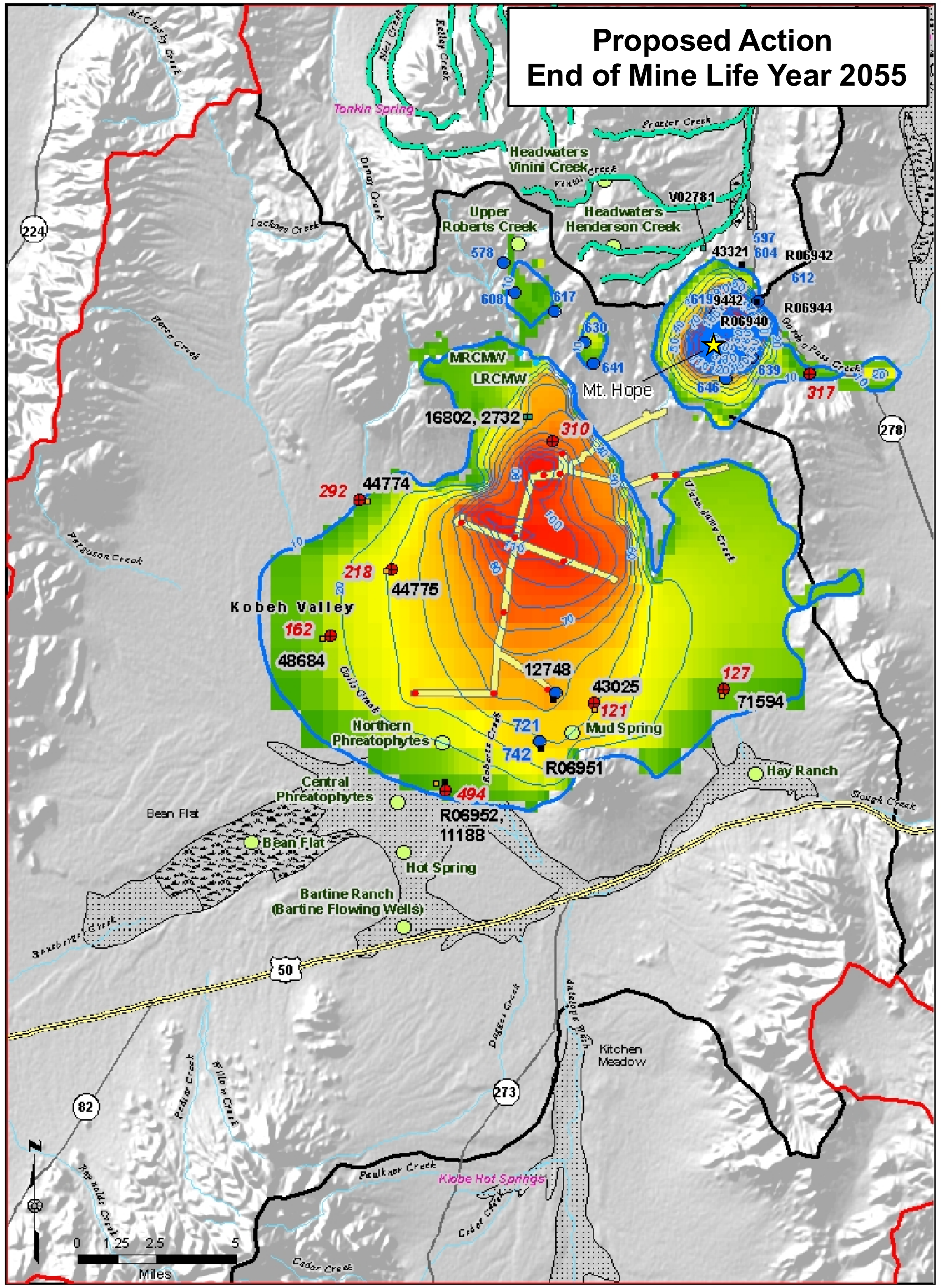
Impacted Water Rights

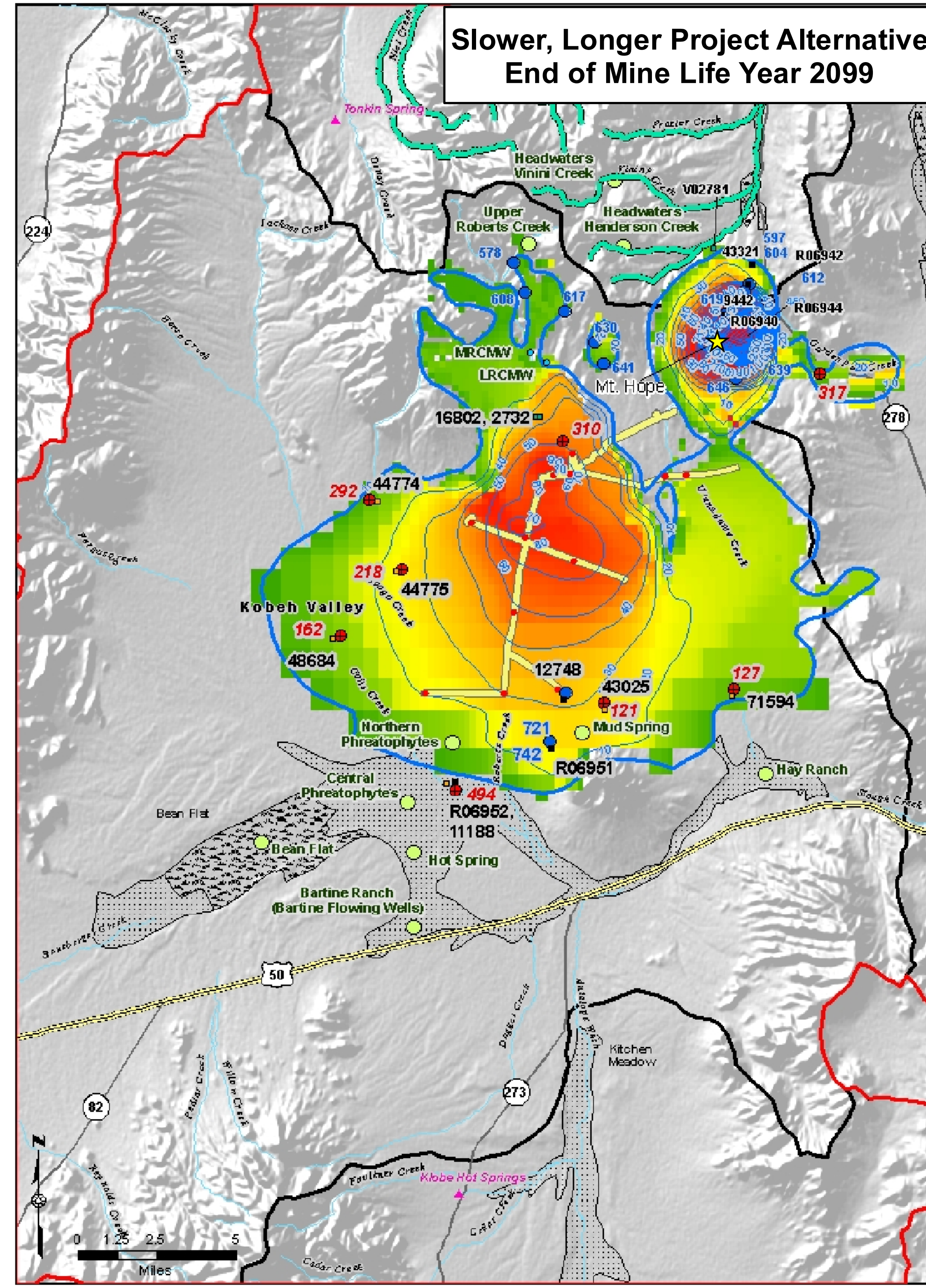
Source Description

- Spring
- Stream
- Groundwater

ID numbers listed in Montgomery et al. (2010)

- 41223 — Water Right Application Number (Appendix C)
- 34 — Well ID (Appendix D)
- 34 — Spring ID (Appendix B)
- Non EMLLC-Water Well
- Spring





BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

0 1.25 2.5 5 Miles

DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD
CHECKED: -	APPROVED: RFD	DATE: 08/03/2012

FILE NAME: p1635_Fig3-2-29_ExtendedAlt_ProposedAction_DD_SideBySide.mxd

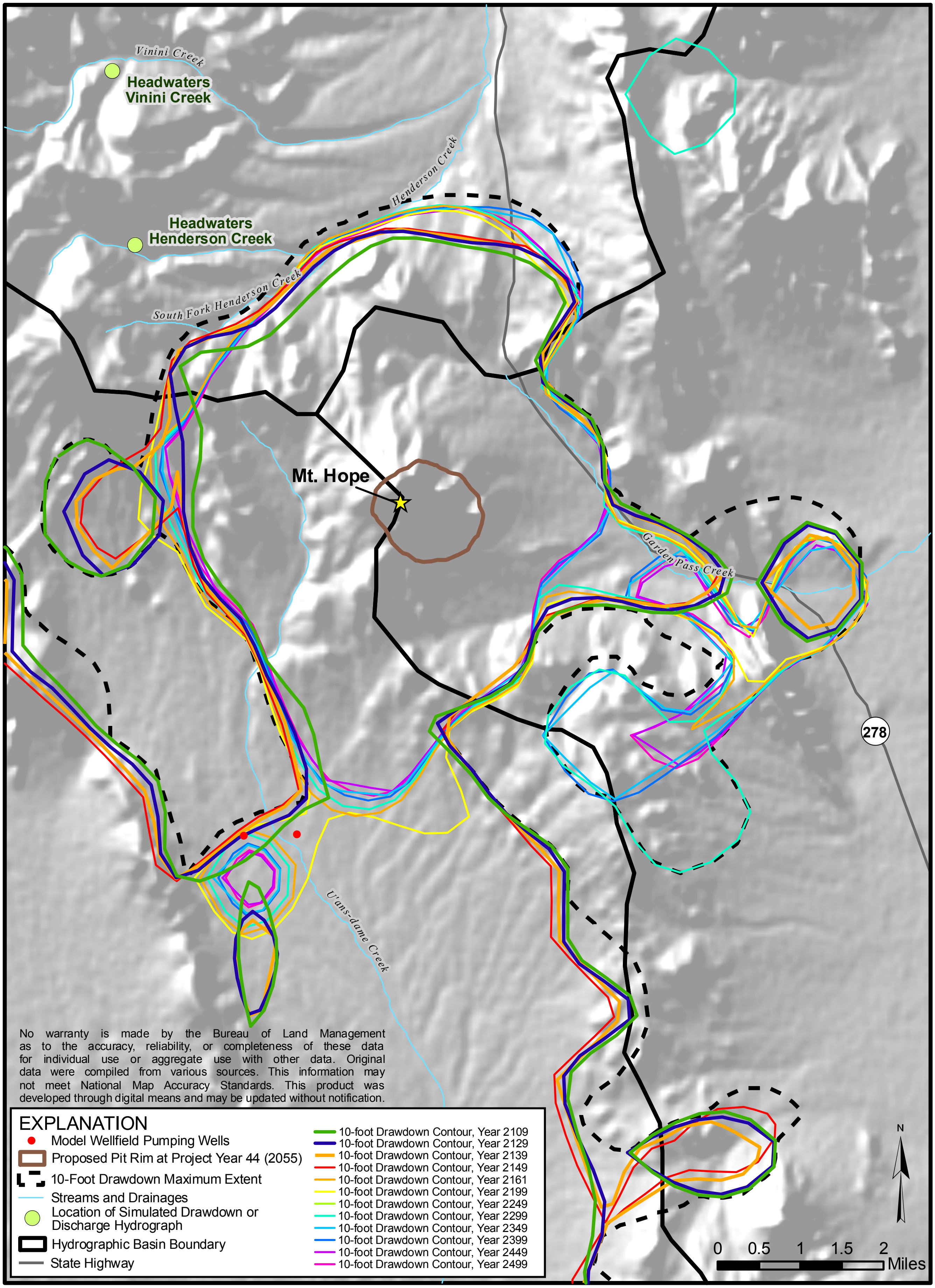
BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Projected Drawdown of Water Table for Proposed Action Mine Year 44 (2055) and Slower, Longer Project Alternative Mine Year 88 (2099)

Figure 3.2.29



BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD
CHECKED: -	APPROVED: RFD	DATE: 08/06/2011
FILE NAME: p1635_Fig3-2-30_ExtendedAlt_DDPostYears.mxd		

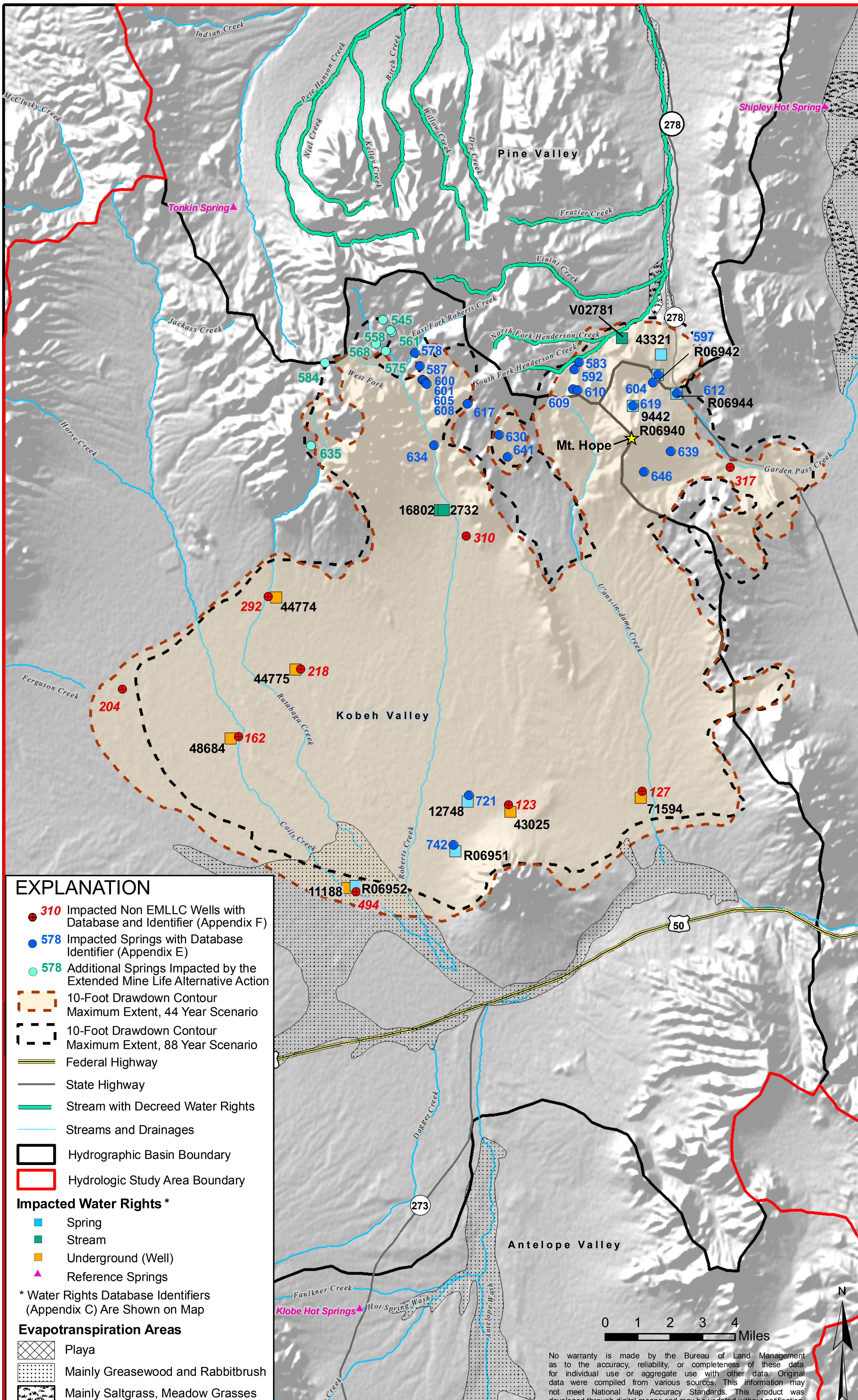
BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Slower, Longer Project Alternative - Simulated Ten-Foot Water Table Drawdown Contours During 400 Years of Post-Mining Recovery

Figure 3.2.30



BATTLE MOUNTAIN DISTRICT OFFICE Mount Lewis Field Office 50 Bastian Road Battle Mountain, Nevada 89820 DESIGN: EMLLC · DRAWN: GSL · REVIEWED: RFD CHECKED: - · APPROVED: - · DATE: 08/06/2012 FILE NAME: p1635_Fig3-2-31_ExtendedAlternative_CompYr44_88.mxd	BUREAU OF LAND MANAGEMENT MOUNT HOPE PROJECT	DRAWING TITLE: **Comparison of Proposed Action and Slower, Longer Project Alternative with Respect to Springs, Non-EML Wells and Water Rights within the Composite Maximum Extent of the Ten-Foot Drawdown Contour** **Figure 3.2.31**	

it was conservatively assumed that all of the springs located in this area projected to experience ten feet or more of drawdown are interconnected with the regional ground water system and potentially could be impacted due to water-table lowering attributable to the Slower, Longer Project Alternative.

Surface flow in Roberts Creek diminishes below the confluence of its upper three forks, where the creek enters a small limestone canyon for approximately one mile and then opens into a broad alluvial channel after the stream exits the mountain valley. It is assumed that stream flow in that reach could potentially be impacted due to water-table lowering attributable to the Slower, Longer Project Alternative because the simulated ground water drawdown is greater than ten feet beneath a perennial segment of Roberts Creek.

Surface water flow in the South Fork of Henderson Creek, located approximately three miles northwest of the proposed open pit, is perennial and is believed to be sustained by both perennial and non-perennial springs in headwater drainages that feed into the creek. Year-round flow occurs along at least a two-mile segment of the South Fork of Henderson Creek and ceases near its confluence with the North Fork of Henderson Creek, where all of the surface water flow is lost to infiltration and **ET**. It is assumed that stream flow in that reach potentially could be impacted due to water-table lowering attributable to the Slower, Longer Project Alternative because the simulated ground water drawdown is greater than ten feet beneath a perennial segment of the South Fork of Henderson Creek. The other streams in the HSA are either located outside of the maximum-extent-of-drawdown induced by the Slower, Longer Project Alternative, or are intermittent or ephemeral streams that would not be expected to be significantly impacted by mine-related dewatering and KVCWF pumping.

The actual impacts to individual stream reaches or springs would depend on the source of ground water that sustains the perennial flow (perched or hydraulically isolated aquifer versus regional ground water system) and the actual extent of mine-induced drawdown that occurs in the area. The interconnection (or lack thereof) between perennial surface water features and deeper ground water sources is controlled in large part by the specific hydrogeologic conditions that occur at each site. Considering the complexity of the hydrogeologic conditions in the region and the inherent uncertainty in numerical modeling predictions relative to the exact areal extent of a predicted drawdown area, it is not possible to conclusively identify specific stream segments or springs that would or would not be impacted by future mine-induced ground water drawdown**; however, for the springs nearest to the open pit, flows would be reduced or eliminated in perpetuity**.

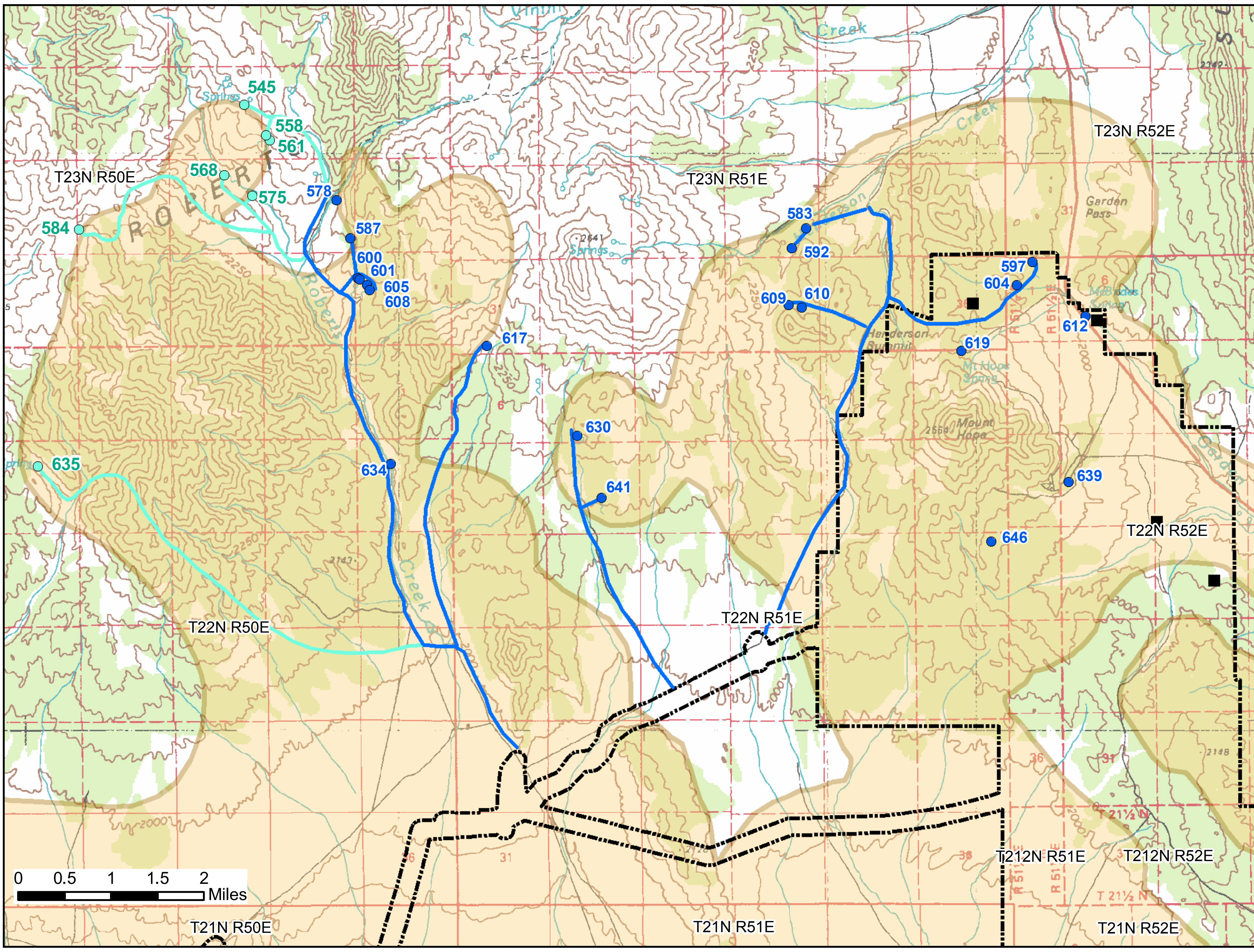
If the Project under this alternative is approved, EML would be required to monitor surface and ground water to assess the extent of drawdown from open pit dewatering and ground water production over time and the potential effects to surface waters.

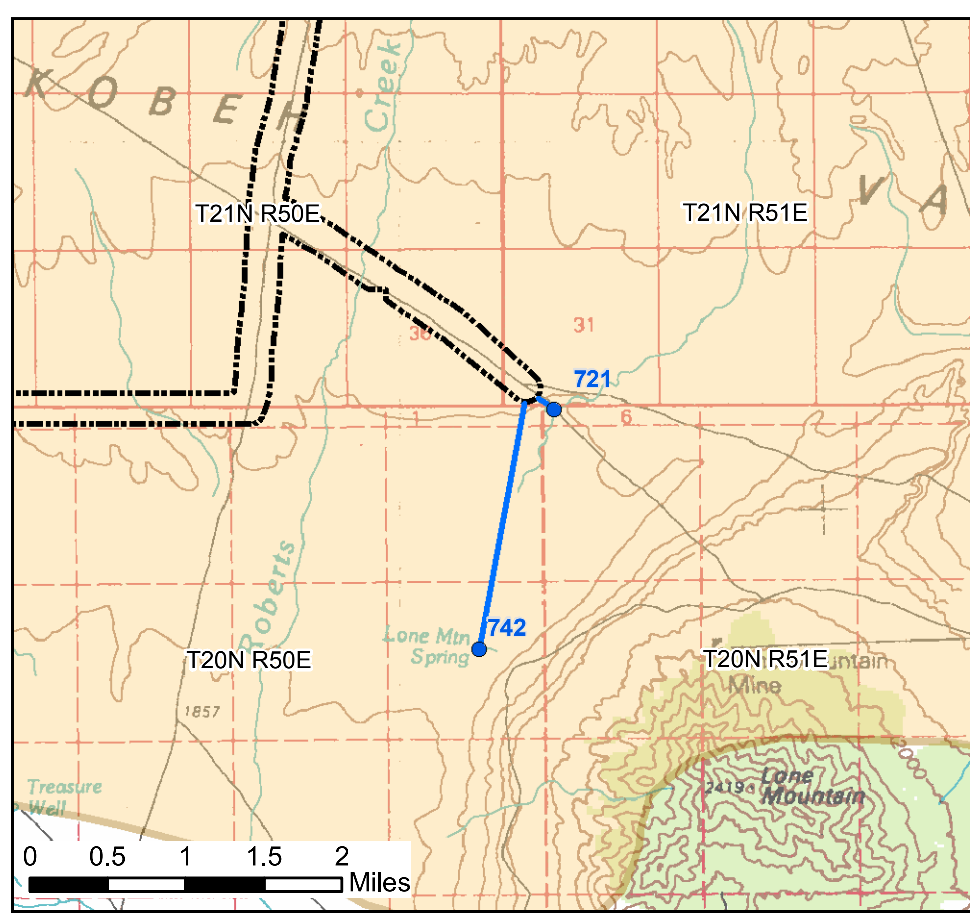
- **Impact 3.2.3.7-2:** The ground water drawdown is predicted to be more than ten feet for two perennial stream segments (Roberts Creek and South Fork of Henderson Creek) and at 29 perennial or potentially perennial spring sites (Tables 3.2-8 and 3.2-17) for varying periods of time up to at least 400 years after the end of mining and milling operations. **Other individual streams and springs outside of the model predictions could also be impacted.**

Significance of the Impact: The impacts are potentially significant at the two stream segments and 29 springs mentioned above. Although significant impacts are not predicted to occur in the other individual streams or springs in the HSA, the uncertainty of predicting impacts to streams and springs indicates a need for operational monitoring and mitigation measures to be implemented. If **monitoring, which has been incorporated into the mitigation measure, indicates that there are** reduced flows in perennial stream segments or springs that the BLM determines can be attributed to the mining operation, then **specific** mitigation would be implemented, as described below. Potential adverse effects to surface water rights would be mitigated **under** NDWR jurisdiction.

- **Mitigation Measure 3.2.3.7-2a:** Specific mitigation for the two perennial stream segments and **29** perennial or potentially perennial spring sites are outlined in Tables 3.2-9 and 3.2-18. **Figure 3.2.32 shows the anticipated location for the components of the facilities necessary to implement the mitigation measures outlined in Table 3.2-9. Implementation of any of the specific mitigation outlined in Table 3.2-9 for springs located on private land would be subject to the authorization of the private land owner. The site-specific evaluation of the effectiveness of this specific mitigation for each identified surface water resource within the mine-related ground water drawdown area is presented in Table 3.2-9. The site-specific measures include one or more methods identified in Mitigation Measure (3.2.3.7-2b). Similar methods (as identified in Table 3.2-9) would also be applied to streams and springs not identified in this analysis, if monitoring indicates that there are impacts that the BLM determines can be attributed to the mining operation.** Implementation of the mitigation outlined in these tables would result in a total of up to **approximately 57.3** acres of surface disturbance associated with the pipeline construction and maintenance (i.e., up to **approximately 37.2** acres of surface disturbance associated with the mitigation for the 22 springs outlined in Section 3.2.3.3 and up to **approximately** 20.1 acres associated with the mitigation for the seven additional springs potentially impacted by this alternative)**, as well as the need for approximately 313 acre-feet of water that would at least initially come from EML's existing water rights if additional water rights have not been secured. This specific mitigation would be implemented, as determined by the BLM, based on the results of the monitoring that is also outlined in this mitigation measure.** EML would implement the water monitoring provisions outlined in Section 2.1.15 and Appendix **C** to track the drawdown associated with the open pit dewatering and water production activities. In addition, EML would update the ground water flow model, as determined by the BLM. EML would be responsible for monitoring and annual reporting of changes in ground water levels and surface water flows prior to and during operation, and for a period of up to 30 years in the post mining and milling phase. **The reports would be in a format and with a content that is acceptable to the BLM. The monitoring outlined in Appendix C and required in this mitigation measure would be used to document the effectiveness of the implemented specific mitigation activities. In addition, the BLM has the ability to require the implementation of additional mitigation measures if the initial implementation is unsuccessful.**

- **Mitigation Measure 3.2.3.7-2b:** If monitoring (Mitigation Measure 3.2.3.7-2a) indicates that flow reductions of perennial surface waters are occurring and that these reductions





EXPLANATION

- Project Boundary
- 10-Foot Drawdown Maximum Extent, 88 Year Scenario
- Impacted Mine Only Springs
- Additional Springs
- Guzzler Installations
- Proposed Action Pipelines with Existing and New Roads
- Slower, Longer Project Alternative Pipelines with Existing and New Roads

N

BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD
CHECKED: -	APPROVED: RFD	DATE: 08/08/2012

FILE NAME: p1635_Fig3-2-32_SurfaceWaterMitigationComponentsSlowerLonger.mxd

BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Slower, Longer Project Alternative Surface Water Mitigation Components

Figure 3.2.32

Table 3.2-18: Surface Water Resources Specific Mitigation for the Additional Springs Potentially Impacted by the Slower, Longer Project Alternative

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics	Associated Riparian/ Wetland Vegetation (acres)[2]	Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate)
545	Unnamed Spring	*	This site is a spring that discharges to a riparian area. This site supports an established riparian vegetation community. This site shows utilization by livestock and wildlife.	0.052	Water supply for wildlife, livestock, and wild horses.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-1: Pipe water along an existing road, approximately 2.4 miles long, from the pipeline for spring 578 at a sustained rate of approximately 1.0 gpm.	The mitigation plan for SSMM-1 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 4.4 acres of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**
558	Unnamed Spring Milk Ranch Spring)	4.00	This site is a spring that discharges to a riparian area. This site supports an established riparian vegetation community. This site shows utilization by livestock and wildlife.	0.052	Water supply for wildlife and livestock use.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-2: Pipe water along a new road, approximately 0.4 miles long, from the pipeline to spring 545 at a sustained rate of approximately four gpm.	The mitigation plan for SSMM-1 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 1.0 acres of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics	Associated Riparian/ Wetland Vegetation (acres)[2]	Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres- approximate)
									loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.
561	Unnamed Spring	4.90	This site is a spring that is piped to a surface discharge. This site supports an established riparian vegetation community. This site shows utilization by livestock and wildlife.	0.104	Water supply for wildlife, livestock, and wild horses.	Reduction of hydrophilic vegetation below established threshold coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-3: Pipe water along a new road, approximately 0.1 miles long, from the pipeline to spring 558 at a sustained rate of approximately four gpm.	The mitigation plan for SSMM-3 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 0.2 acres of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics	Associated Riparian/ Wetland Vegetation (acres)[2]	Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate)
568	Unnamed Spring	*	This site is a seep with saturated soil, but not contributing flow into the drainage. This site supports a riparian vegetation community. This site shows moderate livestock use for water.	0.052	Water supply for wildlife and wild horses with limited livestock use.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-4: Pipe water along an existing road, approximately 0.1 miles long, from the pipeline to spring 575 at a sustained rate of approximately 1.0 gpm.	The mitigation plan for SSMM-4 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 0.1 acres of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**
575	Unnamed Spring	0.24	This site is a spring that discharges to a riparian area. This site supports an established riparian vegetation community. This site shows utilization by livestock and wildlife.	0.104	Water supply for wildlife, livestock, and wild horses.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-5: Pipe water along an existing road, approximately 1.4 miles long, from the pipeline to spring 584 at a sustained rate of approximately 0.2 gpm.	The mitigation plan for SSMM-5 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 1.7 acres of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat,**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics	Associated Riparian/ Wetland Vegetation (acres)[2]	Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate)
									air quality impacts, and potential impacts to cultural resources.
584	Unnamed Spring	0.42	This site is a spring that discharges to a riparian area. This site supports an established riparian vegetation community. This site shows utilization by livestock and wildlife.	0.052	Water supply for wildlife, livestock, and wild horses.	**Reduction** of flow coincident with a reduction in ground water levels in this area, as determined from ground water monitoring.	SSMM-6: Pipe water along an existing road, approximately 3.1 mile long, from the pipeline to spring 578 at a sustained rate of approximately 0.4 gpm.	The mitigation plan for SSMM-6 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 3.8 acres of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**

Spring Number	Spring Name	Flow (gpm)[1]	Site Characteristics	Associated Riparian/ Wetland Vegetation (acres)[2]	Use	Mitigation Trigger	Contingency Mitigation Plan	Effectiveness of Site-Specific Mitigation Plan	New Disturbance From Mitigation Implementation[3] (acres-approximate)
635	Unnamed Spring	0.77	This site consists of a man-made pond. The site has little riparian vegetation around the edge of the pond. This site show heavy use by wildlife and wild horses for water.	0.104	Water supply and riparian habitat for wildlife, livestock, and wild horses.	Reduction of hydrophilic vegetation below established threshold coincident with a reduction in ground water levels in this area, as determined from ground water monitoring	SSMM-7: Pipe water along an existing road, approximately 7.3 mile long, from the Project water supply system at a sustained rate of approximately 0.7 gpm.	The mitigation plan for SSMM-7 would be highly effective at maintaining habitat diversity and would provide a perennial water supply for livestock, wildlife, and wild horse uses.	Up to approximately 8.9 acre of new surface disturbance for the installation and maintenance of the water pipeline. **This surface disturbance would result in a loss of vegetation and associated wildlife habitat, air quality impacts, and potential impacts to cultural resources.**

[1]All flow data in this table from SRK 2007e, except springs identified with an *, which indicates that no flow data were available.
[2]All acreage data in this table are estimated from SRK 2007e or Google Earth™.
[3]Disturbance areas would be managed and reclaimed in accordance with BLM and State of Nevada requirements.

This Page Intentionally Left Blank

are likely the result of mine-induced drawdown, the following measures would be implemented:

1. The BLM would evaluate the available information and determine whether mitigation is required.

2. If mitigation would be required by the BLM, then EML would be responsible for preparing a detailed, site-specific plan to enhance or replace the impacted perennial water resource(s). Potential adverse effects to water rights would be mitigated **under** NDWR jurisdiction**, as well as potential need for additional BLM permit acquisition activities and NEPA analysis**. The mitigation plan would be submitted to the BLM identifying the excess in drawdown or drawdown impacts to surface water resources. Mitigation would depend on the actual impacts, site-specific conditions, and historical use and could include a variety of measures (e.g., flow augmentation, on-site or off-site improvements). Methods to enhance or replace the impacted perennial water resources include, but are not limited to, the following:

   - Modification**, including cessation,** of pumping distribution in the water supply well field;
   - Injection to confine the drawdown cone;
   - Installation of a water-supply pump in an existing well (e.g., monitoring well);
   - Installation of a new water production well;
   - Piping from a new or existing source;
   - Installation of a guzzler;
   - Enhanced development of an existing seep or spring to promote additional flow;
   - **Water hauling;**
   - **Removal of Piñon-Juniper in impacted watersheds;** or
   - Fencing or other protective measures for an existing seep to maintain flow.

3. An approved site-specific mitigation plan would be implemented followed by monitoring and reporting to measure the effectiveness of the implemented measures.

■ **Mitigation Measure 3.2.3.7-2c:** The numerical ground water flow modeling indicates that some impacts to springs may occur after the end of mining and milling operations, when some of the operational measures described above may not be available. For the post-Project delayed impacts of drawdown, the ground water flow model would be updated during the closure process consistent with regulations and policies using the accumulated field data for pumping rates, consumptive use, and observed drawdown within the HSA to re-evaluate projected drawdown that would occur after the end of mining and milling operations. If the BLM determines that the Project would impact perennial stream segments or spring sites in this post-operational phase, mitigation consisting of one or both of the following measures would be required:

1. Installation of a well and pump at affected stream or spring locations to restore the historic yield of the affected surface water resource.

2. Posting of an additional financial guarantee to provide for potentially affected water supplies in the future.

- **Effectiveness of Mitigation and Residual Effects:** Mitigation would be designed to address the specific spring or surface water that is affected, which enhances the effectiveness of the mitigation. In addition, a variety of approaches to mitigation can be used within these measures to achieve the objective. These mitigation measures are expected to be effective because the mitigation measures are specifically intended to directly address the impact by restoring or enhancing surface flows, and because the measures would be reviewed and addressed by the BLM. The effectiveness of Mitigation Measure 3.2.3.7-2c, if implemented, is less certain since it would occur many decades in the future. If initial implementation was not successful, the BLM may require implementation of additional measures. The feasibility and success of mitigation would depend on site-specific conditions and details of the mitigation plan. However, **this type of mitigation has been proven to be effective and** if measures used in Mitigation Measure 3.2.3.7-2b are implemented, then the measure should be effective at mitigating the impacts from reduced surface water flows. Over a long period of time (tens to **hundreds** of years) the effects to most surface water flows would diminish; however, for the springs nearest to the open pit, flows would be reduced or eliminated in perpetuity.

3.2.3.7.2 Ground Water Resources

Lowering of the Water Table

Impacts to Ground Water Resources

Potential impacts to the water resources and thus the associated ground water users within the HSA resulting from mine-related ground water drawdown under the Slower, Longer Project Alternative would be similar as for the Proposed Action, as described in Section 3.2.3.3.2. Therefore, they are not repeated here.

- **Impact 3.2.3.7-3:** The ground water drawdown is predicted to exceed ten feet at the locations of seven wells with associated **active** ground water **use with water** rights, which is similar to those under the Proposed Action.

  Significance of the Impact: Impacts to the seven wells with associated **active** ground water **use with water** rights listed in Table 3.2-10 are potentially significant until such time as the ground water level recovers to less than ten feet of drawdown, which is predicted to be less than 100 years post-Project in all cases. The impacts would become less than significant after implementation of the mitigation measures described below. Potential adverse effects to ground water rights would be mitigated **under** NDWR jurisdiction. **Therefore, no mitigation measures are proposed by the BLM for ground water rights. Section 3.26 includes suggested mitigation outside the BLM's jurisdiction for water rights.**

- **Mitigation Measure 3.2.3.7-3a:** For the seven wells with associated **active** ground water **use with water** rights EML would assess the distance of the screened interval and the pumping below the ground water table. If that difference is greater than maximum predicted drawdown, then EML would pay the water right holder for the increase in pumping costs based on historical usage. If the difference is greater than ten feet, then EML would pay for either the lowering of the pump to a depth greater than the maximum drawdown in the well, or the completion of a new well with the a screened depth greater than the maximum predicted drawdown and pay the water right holder for the increase in pumping costs based on historic usage. In addition, EML would implement the water monitoring provisions outlined in Section 2.1.15 and Appendix **C**. If, through implementation of the water monitoring it is determined that there are impacts to wells with associated **active** ground water **use with water** rights attributable to the Project, whether predicted or not, then the following mitigation measures would be implemented. The combined surface water and ground water monitoring results would be used to trigger the implementation of Mitigation Measure 3.2.3.7-3b.

- **Mitigation Measure 3.2.3.7-3b:** If monitoring (Mitigation Measure 3.2.3.7-3a) indicates that mine-induced drawdown impacts **a well** with associated **active ground** water **use with water** rights, the following measures would be implemented:

  1. The BLM would evaluate the available information and **if the drawdown can be attributed to impacts from the Project, the mitigation described above would be required**.

  2. If mitigation is required by the BLM, then EML would be responsible for preparing a detailed, site-specific plan to enhance or replace the impacted ground water. The mitigation plan would be submitted to the BLM identifying drawdown impacts to ground water resources. Mitigation would depend on the actual impacts and site-specific conditions and could include the following:

     - Lowering the pump in an existing well;
     - Deepening an existing well;
     - Drilling a new well for replacement of water supply;
     - Providing a replacement water supply of equivalent yield and general water quality;
     - Pay for an incremental increase in pumping costs;
     - Modifying the KVCWF pumping regime (well locations or rates) during operations to reduce drawdown in the area of the impacted ground water resources;
     - Infiltrating or injecting water during operations at strategic locations to limit drawdown propagation in certain areas.

  3. An approved site-specific mitigation plan would be implemented followed by monitoring and reporting to measure the effectiveness of the implemented measures.

- **Mitigation Measure 3.2.3.7-3c:** For any significant impacts to wells with associated **active** ground water **use with water** rights that do not occur until after the end of mining and milling operations, the operational measures described above may not be available. For the post-Project delayed impacts of drawdown, the ground water flow model would be updated during the final year of the Project using the accumulated field data for pumping rates, consumptive use, and observed drawdown within the HSA to re-evaluate projected drawdown that would occur after the end of mining and milling operations. Wells **with** associated active ground water **use with water** rights that are not owned or controlled by EML that are indicated to be significantly impacted would then be mitigated by **EML using** one or more of the following measures, as directed by the NDWR, the BLM, or the appropriate regulatory agency:

1. Installation of a deeper well and pump at affected locations to restore the historical yield of the well (including incremental increase in pumping costs).

2. Posting of a funding mechanism to provide for potential future impacts to potentially affected water **sources**.

- **Effectiveness of Mitigation and Residual Effects:** Implementation of the Mitigation Measure 3.2.3.7-3b and the use of any of the options outlined above would be effective at mitigating the impacts to **wells with associated active** ground water **use with water** rights. Mitigation would be designed to address the specific ground water source that is affected, which enhances the effectiveness of the mitigation. These mitigation measures are expected to be effective because the mitigation measures are specifically intended to directly address the impact by providing financial compensation or ensuring that the water is made available, and because the measures **would** be reviewed and assessed by the BLM. If initial implementation was not successful, the BLM may require implementation of additional measures. The feasibility and success of mitigation would depend on site-specific conditions and details of the mitigation plan. Any residual effects to ground water rights would be mitigated and over a long period of time (tens to **hundreds** of years) the drawdown effects should fully diminish, except in the vicinity of the open pit where the effects would be in perpetuity.

<u>Impacts to Basin Water Budgets</u>

Potential impacts to the water budgets of the basins in the HSA resulting from mine-related ground water drawdown under the Slower, Longer Project Alternative would be similar in scale to those of Proposed Action, as described in Section 3.2.3.3.2, but differing in time frames.

The estimated changes in annual ground water budgets under the Slower, Longer Project Alternative indicate that the mine-induced drawdown associated with pit dewatering and KVCWF pumping is predicted to result in a decrease in **ET** in all basins of the HSA. Most of the predicted decrease (95 percent at 50 years after the end of mine-related pumping) in **ET** within the HSA occurs in Kobeh Valley. The predicted water table drawdown in Kobeh Valley extends to the mapped phreatophyte areas northwest of Bean Flat and east of Lone Mountain (Figure 3.2.2**6**). The predominant phreatophyte vegetation in these areas is greasewood. The simulated extinction depth for greasewood is 40 feet below the ground surface, and the ground water model results indicate that the magnitude of drawdown along the perimeter of these phreatophyte vegetation areas would exceed the extinction depth for some period of time (Montgomery et al. 2010). This could potentially lead to a **change in composition and percent**

cover of phreatophyte plants and an associated decrease in **ET** of ground water, as reflected in the estimated water budget changes listed in Tables 3.2-19 and 3.2-20.

Table 3.2-19: Estimated Change in Annual Ground Water Budgets in Final Year of Project (2099) Under the Slower, Longer Project Alternative, Relative to the No Action Alternative[1]

Budget Component	Antelope Valley	Diamond Valley	Kobeh Valley	Pine Valley (within the HSA)	Entire HSA
Change in Ground Water Inflow[2] (afy)					
Precipitation Recharge	0	0	0	0	0
Subsurface Inflow[4]	0	36 (52 from Pine Valley and -16 from Kobeh Valley)	205 (7 from Monitor Valley, 36 from Antelope Valley, and 162 from Pine Valley)	0	7 (from Monitor Valley to Kobeh Valley)
Net Change in Total Inflow	**0**	36	**205**	**0**	7
Change in Ground Water Outflow[2] (afy)					
Evapotranspiration[3]	-23	-72	-3,300	-25	-3,420
Net Ground Water Pumping	0	0	11,300	0	11,300
Subsurface Outflow[4]	36 (to Kobeh Valley)	0	16 (to Diamond Valley)	214 (52 to Diamond Valley and 162 to Kobeh Valley)	0
Net Change in Total Outflow	**13**	**-72**	**7,984**	**189**	**7,880**

[1] Estimation based on sources of data and methods described in Interflow (2011), including results from the calibrated numerical ground water model.
[2] Positive values indicate increase and negative values indicate decrease in water budget component or in net change in total inflow and outflow.
[3] Includes ET from phreatophyte areas and evaporation from playas and spring discharge.
[4]Source: Interflow (2011), Table 1.

Table 3.2-20: Estimated Change in Annual Ground Water Budgets 50 Years Post-Project (2149) Under the Slower, Longer Project Alternative, Relative to the No Action Alternative[1]

Budget Component	Antelope Valley	Diamond Valley	Kobeh Valley	Pine Valley (within the HSA)	Entire HSA
Change in Ground Water Inflow[2] (afy)					
Precipitation Recharge	0	0	0	0	0
Subsurface Inflow[4]	0	39 (35 from Pine Valley and 4 from Kobeh Valley)	171 (17 from Monitor Valley, 31 from Antelope Valley, and 123 from Pine Valley)	0	17 (from Monitor Valley to Kobeh Valley)
Net Change in Total Inflow	**0**	39	**171**	**0**	**17**
Change in Ground Water Outflow[2] (afy)					
Evapotranspiration[3,4]	-27	-117	-1,764	-49	-1,957

Budget Component	Antelope Valley	Diamond Valley	Kobeh Valley	Pine Valley (within the HSA)	Entire HSA
Net Ground Water Pumping	0	0	0	0	0
Subsurface Outflow[4]	31 (to Kobeh Valley)	0	4 (to Diamond Valley)	157 (35 to Diamond Valley, -1 to North Pine Valley, and 123 to Kobeh Valley)	-1
Net Change in Total Outflow	**4**	**-117**	**-1,760**	**108**	**-1958**

[1] Estimation based on sources of data and methods described in Montgomery et al. (2010), including results from the calibrated numerical ground water model.
[2] Positive values indicate increase and negative values indicate decrease in water budget component or in net change in total inflow and outflow.
[3] Includes ET from phreatophyte areas and evaporation from playas and spring discharge.
[4] Interflow (2011), Table 1.

In the final year of operations under the Slower, Longer Project Alternative (2099), the estimated available ground water in Diamond Valley is predicted to be reduced by 72 afy as a result of open pit dewatering and KVCWF pumping, relative to the No Action Alternative at that same point in time (Table 3.2-11). An increase in subsurface inflow to Diamond Valley of 36 afy (52 afy from Pine Valley and a decrease of 16 afy from Kobeh Valley) is also predicted to occur as a result of open pit dewatering (since the pit is mostly located within the Diamond Valley basin). Fifty years after the end of operations under the Slower, Longer Project Alternative (2149), the estimated available ground water in Diamond Valley is predicted to be reduced by 117 afy as a result of pit-lake capture and previous KVCWF pumping, relative to the No Action Alternative at that same point in time (Table 3.2-12). In 2149, a predicted increase in subsurface inflow to Diamond Valley of 39 afy (35 afy from Pine Valley and 4 afy from Kobeh Valley) results from pit-lake capture. The predicted mine-related reduction in available ground water in Diamond Valley within 50 years post-Project under the Slower, Longer Project Alternative (up to 117 afy) is minor (0.2 percent) in comparison to the estimated consumptive use of ground water for agricultural purposes in Diamond Valley (55,800 afy) in 2009.

The quantity of ground water leaving the HSA by subsurface flow and discharging into northern Pine Valley (the only location of subsurface outflow from the HSA) is not predicted to change significantly as a result of mine dewatering and KVCWF pumping.

- **Impact 3.2.3.7-4:** Ground water flow modeling indicates that there could be up to approximately 25 percent decrease in **ET** of ground water in Kobeh Valley due to **a change in** phreatophyte **composition and percent cover** resulting from temporary mine-induced drawdown.

  Significance of the Impact: The impact is not considered significant.

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

- **Impact 3.2.3.7-5:** Ground water flow modeling indicates that there could be a time-varying net change (decrease or increase) in the available ground water in Diamond

Valley that is due solely to effects of the Slower, Longer Project Alternative by the end of mining and milling operations and for at least 50 years post-Project; however, the magnitude of the predicted changes are less than 0.2 percent, compared to the overall ground water budget for Diamond Valley.

Significance of the Impact: The impact is not considered significant.

No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Consumptive Losses

Potential impacts to water resources in the HSA resulting from long-term consumptive use of ground water under the Slower, Longer Project Alternative would be the same as for the Proposed Action, as described in Section 3.2.3.3.2. Therefore, they are not repeated here.

- **Impact 3.2.3.7-6:** Consumptive use of water during mining and milling operations would support a beneficial use and would not be expected to adversely impact water resources, and EML would have adequate water rights to cover the consumptive use. Long-term consumptive use of ground water by evaporation from the pit lake surface is predicted to be approximately 100 gpm (161 afy) and would continue in perpetuity. This consumptive loss would occur under the Slower, Longer Project Alternative (and the Proposed Action), and so represents a negative impact compared to the No Action Alternative. The 161 afy is less than 0.1 percent of the combined water budget for the Kobeh and Diamond Valleys.

  Significance of the Impact: Impacts during mining and milling operations are less than significant. After those operations cease, direct impacts of pit lake evaporation do not result in significant impacts.

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Potential Impacts Due to Subsidence

The basis for this potential impact and the assessment methodology are similar to those described for the Proposed Action in Section 3.2.3.3.2; therefore, they will not be repeated here. The numerical model shows that under the Slower, Longer Project Alternative, subsidence of up to approximately 1.5 feet would occur in the northern part of the KVCWF area (Figure 3.2.3**3**). The projected lateral extent of subsidence greater than one-half-foot is approximately four miles in radius and is centered on the northern part of the well field area. There is no other predicted land subsidence due to the effects of mine pit dewatering or KVCWF pumping under the Slower, Longer Project Alternative within the HSA.

Potential for Changes to Aquifer Productivity

The greatest potential for permanent deformation would occur in the finer grained sediments (clays and silty clays) that are not the primary water-bearing materials in the basin-fill aquifer of

Kobeh Valley. The result would be a slight loss in aquifer interbed storage, but no noticeable loss in aquifer productivity of water supply wells. Thus, the potential impacts to the aquifer due to subsidence under the Slower, Longer Project Alternative, if any, would be localized and are not considered significant.

- **Impact 3.2.3.7-7:** A small change in aquifer characteristics is expected to result from compaction of the aquifer materials. Ground subsidence of greater than one-half-foot is projected to extend approximately four miles quasi-radially from the center of subsidence effects in the northern part of the KVCWF area, and a maximum subsidence of approximately 1.5 feet is projected in a small part of that central area. The subsidence would result primarily from a permanent reduction in porosity of the finer grained sediments (clays and silty clays), which are not the primary water-bearing materials in the basin-fill aquifer.

  Significance of the Impact: The potential for the Kobeh Valley basin-fill aquifer to transmit or store water is not expected to be significantly impacted**.**

  No mitigation is proposed for this impact; see Section 3.1.1 for a general discussion of significance and the development of mitigation measures.

Potential for Significant Land Surface Alteration

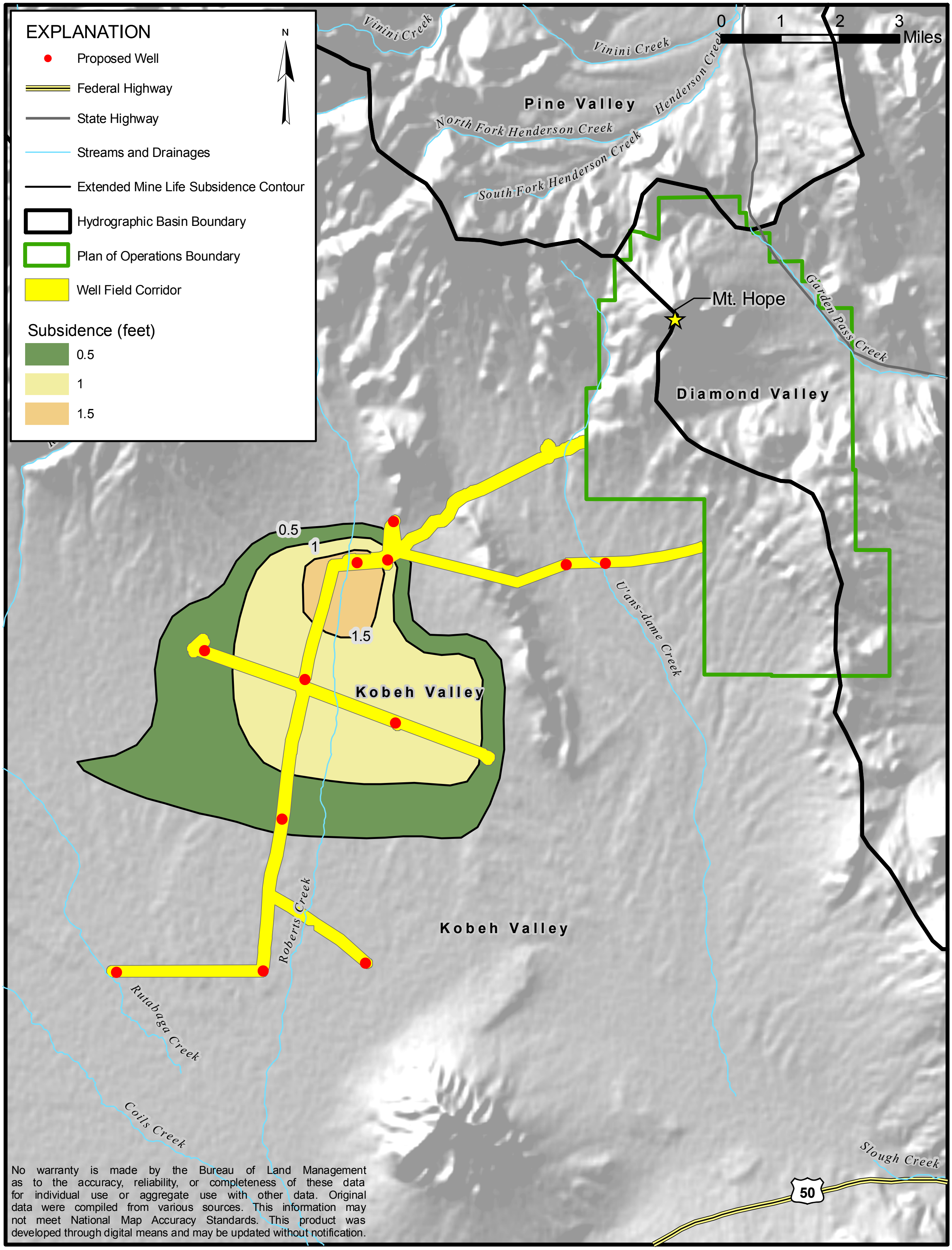
Potential impacts to ground surface conditions (fissuring or alteration of drainage patterns) resulting from dewatering-induced land subsidence under the Slower, Longer Project Alternative would be the same as for the Proposed Action, as described in Section 3.2.3.3.2. Therefore, they are not repeated here.

- **Impact 3.2.3.7-8:** Differential subsidence could result in the development of fissures, creating a potential to degrade waters of the state. Fissures could provide a preferential flow path for uncontained process fluids or chemical or hydrocarbon releases. Capture of surface runoff by fissures, may form erosional fissure gullies, which represent a safety risk to wildlife, livestock, wild horses, and people.

  Significance of the Impact: The impact would be significant if fissure gullies formed.

- **Mitigation Measure 3.2.3.7-8:** EML would be responsible for specifically monitoring for fissure gully development. If fissure gullies form, they would be filled in with clean, coarse-grained alluvium, with the intent of providing a rapid means of dissipation for any surface water entering the fissure, thereby reducing the propagation of the fissure through continued erosion. The fill material then would be seeded with a BLM-approved seed mix.

- **Effectiveness of Mitigation and Residual Effects:** Implementation of the Mitigation Measure 3.2.3.7-8 would be effective at mitigating the fissures that develop. Any residual effects of fissure development would be fully mitigated during the life of the Project.



BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD
CHECKED: -	APPROVED: RFD	DATE: 08/06/2012

FILE NAME: p1635_Fig3-2-33_ExtendedAlt_SubsidenceKobehValley.mxd

BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Slower, Longer Project Alternative Predicted Subsidence in Year 88 (2099), Relative to 2009 Conditions

Figure 3.2.33